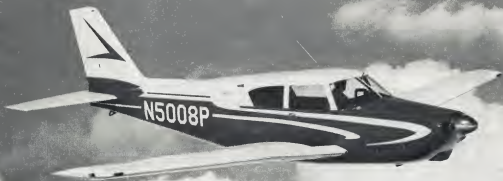


AVIATION WEEK

A MCGRAW-HILL
PUBLICATION

November 11, 1957 75 cents

Designers Study
Temperature Effect
On B-58 Hydraulics



Piper Comanche

Comanche Stable, Rugged in Evaluation



SQUEEZE

waste space out of your design picture

with **KAYLOCK**
All-metal self-locking nuts

Internal/external wrenching Hex Nuts

- USE OF—Internal/external wrenching Hex Nuts:
- Strengthens points of potential fatigue failures.
 - Saves material, space and weight.
 - Eliminates wreck damage to surrounding material.

Make use of these weight, space, and cost saving features by incorporating KAYLOCK internal/external wrenching self-locking Hex Nuts in your designs.

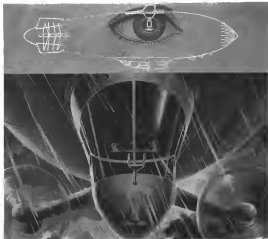
Kaylock Hex Nuts conform to all three Air Force-Navy standards: AN340, AN344, AN365 and the new low height National Aircraft Standard NAS349.

Complete line of Kaylock all-metal self-locking nuts available in steel or corrosion-resistant steel.



Catalog sent on request—

Expamet Mfg. Co., Inc.—Kaylock Division, Dept. 85, Box 2001, Terminal Annex, Los Angeles 24, California © 1977
Canadian Distributor: Alconex Aero Ltd., Montreal, Quebec



They scan the sky with an ALL-SEEING EYE

Carrying the largest radar antennas ever borne aloft, the ship can guard our sky and sea approaches day and night on end—through snow, wind and rain—without relief or refueling.

Only the ship can do it.

Developed by Goodyear Aircraft for the U.S. Navy, this flying sentinel can seal our skies against the danger of surprise attack. For its giant radar antenna affords a sensitivity and scanning range unmatched by other airborne devices.

Moreover, its capacity for riding out

the weather with minimum crew fatigue makes the ship unique among aerial sentries.

Proud Naval airships recently maintained their radar posts for ten consecutive days and nights—through the worst Atlantic storms in 15 years.

And the ship has other important advantages. It's thrifty with fuel. It's adaptable to a wide range of operating conditions. It provides greater living comfort for the crew.

Most important: it can do an effective job with fewer men than any other type of airborne early-warning vehicle.

To the U.S. Navy and the Continental Air Defense Command belongs much of the credit for development of this modified Goodyear ZPG-3W airship. In the years ahead, millions of Americans may sleep better because their coasts are alert and on guard.

They're doing big things at
GOODYEAR AIRCRAFT

Plants in Akron, Ohio, and Lockheed Park, Arizona
Rewarding Careers for Engineers



Amweld® Hits Your Cost Target

Joining and flash butt-welding of rail-related products at Amweld has cut the cost of rings and other circular parts by as much as 50%! Savings to our manufacturer in reduced machining time and material was \$230.00 per ring. Where expensive materials such as 304-stainless steel and heat-treated alloys are used, flash butt-welding offers the most economical and practical method of manufacturing circular products.

Similar economies are also realized in carbon steel and low alloy steels.

Write today. Let our engineering department determine how Amweld can help you cut production costs on rings, flanges and circular components.

THE AMERICAN WELDING & MANUFACTURING CO.
440 Holly Road • Warren, Ohio



AMERICAN WELDING

The World's Largest Manufacturer of Welded Rings

AVIATION CALENDAR

- Nov. 11-Plasma Jet Science Exhibition
Regional Technical Conferences, Society
of Power Engineers, Hotel Ambassador,
Los Angeles
- Nov. 15-16-Thief 192: International
Conference and Exhibit (Data Handling)
Miami Beach, Hotel Miami, Fla.
- Nov. 18-19-1977 International Air Safety
Seminar, Flight Safety Foundation, Falls
Church, Va. (Air Safety Week Society
Aviation Theme No. 18 For details
write FAF, c/o Society for N.Y.C.)
- Nov. 18-National Electrical Association
Annual Convention, Annual Convention
Towers Hotel, Atlanta, Ga., N.Y.
- Nov. 12-15-Soviet Aircraft: Dynamics
Conference, Park Sheraton Hotel, De
troit sponsored by Yavuz Inc. (not
open only)
- Nov. 15-16-Med Science Electronics Con-
ference, Moscovet Conference Center,
Cairo, U.S.A.
- Nov. 15-16-The Science of Technical Writ-
ing and Editing 19th annual conference,
Hotel Sheraton, New York
- Nov. 15-16-1976 Annual Convention, Na-
tional Aviation Trades Assn., Hotel Wald
plex, Dallas
- Nov. 14-Marking on "Navylog" language
computer program professional group
on International Navigation Symposium,
Rm. 1000, 300 North Union Bldg., 60
Madison St., N.Y.C.
- Nov. 15-16-La Conference et Symposium
International, International Airport
Exhibition, Chicago, Ill.
- Nov. 15-16-Third Nuclear Electric Ma-
chine School, International Defense,
Flight Electronics, Rm. 2, 750 S. Palm
Ave., Miami, Fla.
- Nov. 15-16-Motor Group for Aircraft
Self Assembly and Disassembly, Con-
ference and Symposium, Pacific USA, ex-
hibit no. 26, 27, 12122 International
Hotel, Sheraton Hotel, Washington,
D.C.
- Nov. 18-20-1976th Conference, Inter-
national for Transport Tech., Miami, Fla.
(Continued on page 6)

AVIATION WEEK • NOVEMBER 11, 1977

Vol. 47, No. 19

...the most complete and authoritative source for the latest information on the aviation industry. This is the only publication that provides a comprehensive overview of the industry, from the latest developments in aircraft design and construction to the latest trends in aviation finance and management. The publication is a must-read for anyone involved in the aviation industry, whether they are a pilot, a mechanic, a manager, or a shareholder. It is a treasure trove of information that is essential for anyone who wants to stay on top of the latest news and developments in the aviation industry.

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AVIATION WEEK, November 11, 1977

Have You a Difficult PLATING PROBLEM?

Let our experience solve your plating problem!
For twenty-eight years, we have specialized in the finest types of precision plating.

Our technical knowledge, unmatched plating facilities, and experience gained in working out customers' problems combine to offer you the best plating you can buy.

You'll be completely satisfied with Micro Certified Plating!

NATIONWIDE SERVICE

Air shipments make us local platers in your community.

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MICHIGAN CHROME and Chemical Company

Dept. 16, 8615 Greenleaf Ave., Greenleaf 13, Mich.
Please send complete literature to know our plating facilities
without cost.

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| <input type="checkbox"/> Silver Plating 500-100 | <input type="checkbox"/> Cathodic Arc Deposition |
| <input type="checkbox"/> Nickel Plating 500-100 | <input type="checkbox"/> Electroless and Copper Plating |
| <input type="checkbox"/> Lead Plating 500-100 | <input type="checkbox"/> Zinc Plating |
| <input type="checkbox"/> Tin Plating 500-100 | <input type="checkbox"/> Chromium Plating |
| <input type="checkbox"/> Gold Plating 500-100 | <input type="checkbox"/> All types of plating on Alloys |
| <input type="checkbox"/> Nickel Plating 500-100 | <input type="checkbox"/> New plating technology |
| <input type="checkbox"/> Nickel Plating 500-100 | <input type="checkbox"/> New plating technology |

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ADDRESS _____
CITY _____ STATE _____
MAILING _____

AVIATION CALENDAR

(Continued from page 5)

- Nov. 20-22-24th Meeting, American Distributors and Manufacturers Ass., Sheraton-Cabrillo Hotel, Detroit
- Nov. 24-Board of Directors Meeting, Air Transport Ass., Raffles Hotel, London, Eng. U. K.
- Nov. 26-Annual Membership Meeting, Air Transport Ass., Sheraton Hotel, Washington, D. C.
- Nov. 28-19th Annual Bonspiel Meeting, Can. Ind. (Sheraton Hotel, Kansas, N. Y.)
- Dec. 2-3-American Rocket Society, annual meeting, Hotel Statler, New York
- Dec. 1-4-19th Factors in Science Day, evening, Institute of Radio Engineers at Sheraton Factors Society of America, First Sheraton Hotel, Philadelphia, Pa.
- Dec. 4-5-Grouping on high temperature steel pipes, "International Science and Technology, North Atlantic Center, Philadelphia, Pa.
- Dec. 9-10-19th Eastern Joint Computer Conference and Exhibit, Sheraton York Hotel, Washington, D. C.
- Dec. 10-12-1st "Solar Control Symposium, "The Motion and Methods of the Atmosphere, Meteorological Board, sponsored by Franklin Institute, Philadelphia, Pa.
- Dec. 14-Civilian Development speaker, Alan Miles S. S. Symple, UN, at Engineering & National Council, at Engineering Club, Philadelphia, Pa.
- Jan. 6-8-19th National Symposium, The Institute, Philadelphia, and Quality Control Board, Seattle, Wash., D. C.
- Jan. 14-15-Traffic Instrument Fair & Reception, sponsored by Instrument Society of America, Jackson, Connecticut Valley and Fairfield County, Scotland, Hotel Strathclyde, London, Scot.
- Jan. 20-Feb. 7-19th National Institute for Commercial Causes and Economic Policy, University of Southern California, Los Angeles
- Jan. 29-31-19th Annual Meeting, American International Society, N. Y. C.
- Jan. 30-31-American Society for Engineering Education, 1919 College Institute Conference, University of Missouri, San Antonio, Mo.
- Jan. 30-31-19th Annual Instrument Short Course, sponsored by California Motor Association and Los Angeles Harbor Junior College at Los Angeles Harbor College, Westminster, Calif.
- Mar. 17-20-19th Western Conference American Rocket Society American Society of Mechanical Engineers, Sheraton Hotel, Las Vegas, Nev.
- Mar. 17-20-19th Nuclear Congress, sponsored by American Institute of Chemical Engineers, 71 St. 45 St., New York 36, N. Y.
- Mar. 24-25-19th International Institute and Show, Carlton Hotel, Westminster, London
- Apr. 17-18-RUC-BN-15 Runners, (Maid of the Sea), Toronto Canada Coast C. B. Scouting, Chertsey, 191 South Drive, Toronto, Can.
- Apr. 17-18-Institute of Environmental Engineers, Second Annual Technical Meeting, New York Hotel, New York
- Apr. 22-24-19th Electronics Components Conference, Sheraton-Raffles, Applied Science of Components, Paris, France

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ARE A FEW OF
THE CUSTOMERS OF
CLEMO
AERO PRODUCTS, INC.
who lead the field of strength
and guided missiles for the
world today...for the
universe tomorrow

CLEMO AERO PRODUCTS, INC. are furnishing the leaders of the aircraft and missile industry with the following:

RELAY ATTACHMENT	PROPRIETARY DESIGNS OF
PISTON ENGINE GASKETS	HYDRAULIC AND PNEUMATIC
PISTON DAMPERS	WHEELS FOR MILITARY AND
PISTON PINS AND SPRINGS	COMMERCIAL AIRCRAFT AND MISCELLANEOUS



CLEMO
AERO PRODUCTS, INC.
130 E. Mainville St., Carlsbad, California



Upstream!

Most people watching a salmon swim upstream wonder how he does it. Surely he's a lot of courage to move from one wet spot to another. To the salmon, though, the competitive swim upstream cannot be denied.

The titanium industry also has been fighting upstream these past few years. A succession of production upsets and metallurgical wastefalls have been encountered. The disastrous hydrogen embrittlement was successfully thwarted. The industry has now moved through the less white headwaters to fully competitive equality with other structural metals.

Titanium alloys of high strength, light weight

and outstanding corrosion resistance are available from T.M.C.A. in all wall forms and in a full range of sizes and gauges—sheet, bar, billet, extrusions, tubing and wire. Special heat-treated sheet of very close gauge and stress tolerance is in production for advanced aircraft and missiles.

Further expansion of sponge production and metal finishing facilities at T.M.C.A. are bringing titanium within reach of an ever-expanding market. Technical information and specialized engineering services are available for solving those applications beset by strength, weight or corrosion challenges.

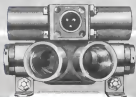
... FIRST IN **Titanium**



TITANIUM METALS CORPORATION OF AMERICA, 233 Broadway, New York 7, N.Y.

ADEL "DESIGN SIMPLICITY" FOR PERFORMANCE RELIABILITY

New Steel Body, Miniature, Solenoid Operated Directional Control Valves



OLD AND NEW VALVES ACTUAL SIZE



SPECIFICATIONS

Non Interflow,
Low Surge Design
Types I & II Sys. (-65°F
to +260°F & +270°F)
Corrosion Resistant
Construction

Operating Pressure Range:
250 to 3000 PSI
Total Pressure Drop:
60 PSI at Rated Flow
Internal Leakage:
15 cc/ Min. Max. @ 90°F

Solenoid: Continuous
Duty, Single Dry Coil,
18 to 28 V dc operation at
-60°F to +270°F
Current Draw:
1 Amp Max. at 28 V dc

Performance and
qualification tested upon
Oil, Refrigeration,
MIL-D-5605, but suitable
for other fluids

Compared with
similar valves having
aluminum bodies and
steel components, these
new valves provide:

- 1/2 number of seals
- 1/2 number of parts
- 1/2 space requirements
- 1/2 weight

DESIGNED FOR EXTENSIVE STANDARDIZATION OF PARTS

VARIATIONS

- 2 and 3 Position, 4 Way
- 2 and 3 Position, 4 Way with Solenoid Manual
Override
- 3 Position, 4 Way with Manual Manual Override
- Line Sizes: 1/8, 1/4 and 1/2 inch ports per AND
10000



Write today for our
complete literature

Reliability
ADEL PRECISION
PRODUCTS
A DIVISION OF GENERAL MOTORS CORPORATION

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DISTRICT OFFICES: MINNEAPOLIS • DAYTON • WICHITA • DALLAS • TORONTO

ANOTHER FIRST FROM TEMCO



*Temco's target drone "Teal" takes to the air
to sharpen aim of Navy pilots*

The XKST-1, "Teal," designed and developed by Temco as a low-cost, expendable target system, recently made its aerial flight to become the nation's first successful rocket-powered target drone. Carried aloft and launched by an F4H-1M Phantom fighter at 20,000 feet, the "Teal" held a straight course for almost eight minutes—the first flight of such duration for a drone using solid-propellant fuel. Also, the event was the first successful controlled launching of such a device from a shipboard aircraft.

Capable of operating near the speed of sound at altitudes up to 30,000 feet, the "Teal" will serve as a target for

air-to-air missiles and other defensive devices carried by Navy aircraft. It is a Temco development from initial concept to flight readiness, and an outstanding example of Temco's engineering and production capabilities.

The experienced engineer who meets the challenge of a growing organization, plus the prestige of a steadily established company, will find his opportunity at Temco!

*In Engineering, The Best Opportunities Are In Aviation
at Temco, The Best Opportunities Are At Temco*

MR. JIM RUSSELL, Engineering Personnel
Room 1500, Tower Aircraft Corp., Dallas, Texas

Please send me complete details of the Temco story of unusual
opportunities for career engineers. I am especially interested in:

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ADDRESS _____

CITY _____ STATE _____

AIRCRAFT CORPORATION • Dallas, Texas

Another Norden-Kelley Test in Jet Aircraft Instrumentation



Actual Size

NEW ONE INCH JET TACHOMETER INDICATOR with Integral Aviation Red Snap-In Lighting

A circle only 1" in diameter on the instrument panel — that's all Norden-Kelley's new JT-2 tachometer! The important engineering that accomplished such extreme size reduction has packaged a combination of important advantages in this new tachometer indicator design. One of these improvements is the integral aviationized lighting, which is now provided by three oxygen bulbs. Replacement of burn-out bulbs is, literally, a "snap" compared to the older method of detaching leads and soldering in new bulb connections after breaking both

metal seal. The new JT-2 Tachometer Indicator meets Air Force specifications, including MIL-L-30487A. Here is another Norden-Kelley advance that is part of the overall integration of engine instrument display. These new advantages extend the aircraft designer's capabilities in achieving higher standards of performance.

SPECIFICATIONS: Rotator: 5,000 to 0-110% range (3000 to 4500 RPM). Diameter: 1". Length: 2". Accuracy: $\pm 2\%$. Operating temperature range: -30° to $+125^\circ$ F. Hermetically sealed. Lighting: 3 VDC MIL-L-30487A.



Send for this important brochure!

Learn how a versatile Jupiter®
gas turbine engine can help solve your
power problems

SOLAR'S 500 HP JUPITER gas turbine offers a radical new power concept for forward-looking businesses. One of the simplest of all heat engines, it provides reliable power for a wide range of military and commercial applications—including boost propulsion, mechanical drive, power generation and others. New users praise its high power-to-weight ratio, its instant starting even under severe temperature extremes, its easy portability and low maintenance requirements.

Solar has prepared a colorful 24-page booklet giving full details about the Jupiter. It contains all of the information necessary to negotiate with the many advantages of this exciting new engine — and it's yours for the asking. Learn how this power plant of the future can go to work for you—today! Solar Aircraft Company, San Diego 12, California. Designers, developers and manufacturers of gas turbines, expansion joints and aircraft engine, airframe and missile components.

SOLAR AN AIRCRAFT COMPANY

FOR NEW JUPITER BROCHURE, MAIL TO:
Engl. # 156, Solar Aircraft Company,
San Diego 12, California

NAME _____

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COMP. _____

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CITY _____

ENGINEERS' WARNING: Unskilled assembly may compromise safety, and flying with faulty Solar is now reckless.

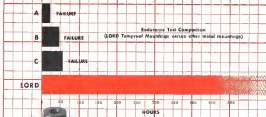


Norden-Kelley's leadership in the design and manufacture of precision flight instruments dates from the development of the first Norden-Brightlight. Through the years, Norden-Kelley engineering has continued to pace the advancements in reliability, accuracy, low induction, and now, the integration of human engineering factors into each instrument design.



Write for Bulletin 494 containing data on various flight instruments to:
Norden-Kelley Corporation, Instrument & Systems Division, Wiley Street, Milford, Conn.
San Diego, Calif. • Dallas • New York • New Orleans • Los Angeles • Chicago

test proves superior endurance of **LORD** temproof mountings



LORD TEMPROOF MOUNTING

PURPOSE: To compare the endurance of several commercial vibration isolators used in the aircraft and missile electronics field. Test was conducted by an independent laboratory.

TEST CONDITIONS: Three competitive models, in sets of four mountings each, were placed under loads of 10 pounds and vibrated simultaneously at frequencies from 5 cps to 44 cps at a double amplitude of .060".

RESULTS: At the conclusion of the test only the Lord Temproof Mountings had functioned 425 hours and were still in service—with no significant change in vibration characteristics. Mounting "A" failed in less than 20 hours, mounting "B" and "C" failed in less than 60 hours.

CONCLUSION: "The Lord Temproof Mounting is more durable than the other vibration isolators tested."

Why hesitate? See request with vibration isolators that provide less than the best performance? For further information, contact your nearest Lord Field Engineer, or the Home Office, Erie, Pa.

ATLANTA, GEORGIA: CDA-7-213
BOSTON, MASS.: MA-100-6 & 104
CHICAGO, ILL.: MA-100-7 & 105
CLEVELAND, OHIO: MA-100-8 & 106
DALLAS, TEXAS: MA-100-9 & 107
PHILADELPHIA, PA.

DAYTON, OHIO: MA-100-10
DETROIT, MICH.: MA-100-11 & 102
INDIANAPOLIS, IND.: MA-100-12 & 103
LOS ANGELES, CALIF.: MA-100-13 & 104
NEW YORK, N.Y.: MA-100-15 & 106
PHILADELPHIA, PA.

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designers
and producers
of bonded
rubber
products
since 1934

300° F

500° F

1000° F

2000° F

HEAT RESISTANT...



AN K connector with
cage-type contacts



PW 65 plug, either crimp
or solder pot contacts



FWH 3345, seal mount
connector, sealed (solder)



FWH 65 plug, via
solder assembly

At extremely low levels or in graded masses, whatever high temperatures are encountered, you can get full protection by using Cannon Metal Seal High Temperature Connectors to protect electrical circuits.

Cannon Electric supplies both MS K and PW (solder types) of electrical connectors for the protection of vital circuits in flame burner applications.

The fireproof test of Military Specification MIL-C-30115 requires that a connector will carry a specified current for 5 minutes and prevent the passage of flame for twenty minutes while being subjected to a flame of 2000° F. Cannon AN K Connectors meet this specification.

In addition to brass plugs Cannon Electric has developed connectors that operate continuously up to 1000° F. Developments are under way that will increase the temperature range. We would like to suggest that you will find it well worth your while to consult our engineering personnel for full information on the new and high temperature connectors available.

For an interesting discussion of the broad subject of "Reliability," write for Cannon Bulletin B-2.

Please refer to Dept. 300



More than 2500 Cannon Connectors serve you the security of allowing exactly the right connector for any particular application you face in your design. Write for Cannon Bulletin B-2.

CANNON PLUGS

WITH ADAPTORS TO THE 57 STANDARD

Five times the population of London and New York



THE WORLD'S TWO MOST POPULOUS CITIES would have to become five times larger to accommodate all the passengers that flew the world's scheduled airlines last year. There were 80,000,000 of them — some 15% more than flew in 1955. And the number of airline passengers is expected to grow to 90,000,000 in 1957.

As passengers and local factors increase, so does the need for new and better aircraft — serviced by new and better petroleum products. Esso Mobilizers provide the growing aviation industry with highest quality fuels and lubricants, perfected by 30 years of Esso research.

A Good Sign to Fly to

Esso

CAPABILITY



With us, *capability* is the sum total of many factors — an applied combination of air-minded industrial installations, highly skilled manpower, and tightly knit organizational spirit.

That spirit is an intangible. It can't be measured specifically like car, train or machine power — but it's just what they help speeded out —

... *capability* to wage an "all-out" attack on difficult production design problems.

... *capability* for constant research and development of new methods of manufacturing products

faster, better and more economically.

... *capability* to meet rigid specifications and meeting delivery schedules

... *capability* for devising and channeling all our experience to a project — no matter what the size.

... *capability* of quality volume at the lowest possible cost.

We're not only capable of all this — we do it! Evidence is the *F-84* — powerful to light engine we manufacture for the Air Force to use in some of its latest and finest aircraft.



AIRCRAFT ENGINE DIVISION • FORD MOTOR COMPANY
7401 SOUTH CICERO AVENUE • CHICAGO 29, ILLINOIS



rocket power from reasoning power

A reasoning mind—man has always found this his most useful weapon when venturing into unknown fields. Today's frontier—one of the greatest unknowns ever faced by man—is outer space.

RMI, America's first rocket family, is uniquely qualified to help our country conquer the new frontier. For this project will require more powerful and more efficient rocket propulsion systems than any yet designed. And RMI's experience in the rocket power field extends back over 15 years . . . years in which RMI scientists and engineers pooled their reasoning power and knowledge

to develop entirely new methods of propulsion and to produce rocket powerplants for dozens of military vehicles.

With this backlog of experience—and with an increasing staff of imaginative, reasoning engineers—RMI continues to show tracks in many fields of rocket power: supersonic missile aircraft . . . versatile helicopters . . . outposts and test sleds . . . and missiles for defense and space exploration.

Engineers, Scientists—Perhaps you, too, can work with America's first rocket family. You'll find the problems challenging, the rewards great.

Power for Progress
RMI
REACTION MOTORS, INC.
A MEMBER OF THE GALT TEAM
DENVILLE, NEW JERSEY

How the Queen's picture kept its charm Introducing "FAXTAPE"—facsimile on a magnetic tape

We were entirely in accord with the British and Canadian points of view. His Majesty's visit to Canada deserved special effort . . . which meant, from an earlier-than-planned recording of magnetic-tape facsimile recording.

To demonstrate photo-line news photos of the occasion, Ampex delivered FAXTAPE machines

one to Canadian Overseas Telecommunications Corporation's Vancouver office. By recording pictures of the wire onto tape, COTC was prepared for automating to overcome with no visible loss of quality—desirable for any subject—even more so for the Queen.



FAXTAPE records its own photographs and provides a watching companion. Left: photo was printed directly off the facsimile wire. Center: the photo after being recorded on tape and retransmitted. Right: the same photograph after being retransmitted the conventional way of a facsimile print.

A SLOW-SCAN COUSIN OF VIDEOTAPE

Ampex's FAXTAPE is a facsimile as Videotape is to television. It records the electrical signals used in picture transmission. Tape playback reproduces electrical voltage patterns, retransmitting the picture and/or feeding a transmitter to make a negative or print.

FAXTAPE is a versatile adaptation of an Ampex PE-1108 instrumentation tape recorder. FM-carrier electronics provide faithful amplitude reproduction for accurate gray-scale with a tape speed of 7 1/2 inches, matching photo-line frequency response of 2000 cycles/sec. A real technical achievement in the system is a tough, shulable tape standard so precise that the drive is only one second per week. This keeps picture show down to imperceptible levels.

PICTURE TRICKS AND PRACTICAL ANSWERS

For news photos, weather maps, documents and military data, picture quality on longer demands simultaneous transmission to all receiving points. From tape, a second-generation facsimile is as good as the original. Even a third or fourth tape generation is entirely acceptable.

For unattended recording, FAXTAPE provides one whole hour of recording time per reel. Unlike a facsimile transceiver, Ampex tape (as does not require redundancy on each picture—and moderately eliminates chance of wrong recording speed or photo development errors. Voice instructions, coding and seek are recorded on the tape to gather with the picture itself.

Lines and radio links can be used more effectively and economically with FAXTAPE. Facsimile can be collected on tape and held for available line time or clear broadcast conditions. Also, when wider frequency bands are available, the tape can be speeded up many fold reducing transmission time accordingly.

Tricks? FAXTAPE plays back an electronic picture. You can stretch it, shrink it, speed it up, slow it down, invert the gray scale, jiggle the colors, or feed it all to a computer—subject only to the limits of human ingenuity. Any ideas?

Can we send you a brochure? Ampex questions as a sample application? Or need more of this information on wire direct? For any of these requests, please write Dept. 44-9.

AMPEX
CORPORATION
FIRST IN MAGNETIC TAPE INSTRUMENTATION
934 CHANTER STREET, REDWOOD CITY, CALIFORNIA

Dealers offices serving all areas of the United States and Canada, Foreign Representatives in countries around the world.

MAGNETIC
TAPE
APPLICATIONS
BY AMPEX

CHIEF'S
9



Area PE 110



Area PE 110



Area PE 110



Area PE 110



Area PE 110



Rigidity! At equal weight, magnesium is 18 times stiffer than steel

Magnesium's unique combination of strength and light weight gives it some outstanding abilities as a structural metal. Take rigidity, for example. A magnesium bar has 52% the stiffness of a steel bar of the same dimensions.

But stiffness increases as the cube of section thickness. So, if thickness of the magnesium is increased to match that of the steel, the magnesium bar will be over 79% more rigid—yet weigh only half as much. And if thickness is further increased until the bar is of equal weight, the magnesium bar will be 18 1/2%—or over 18 times—more rigid!

Similarly, a magnesium bar of equal rigidity to a stainless bar will weigh only 75% as much as the stainless bar. At equal weight, the magnesium bar will be over twice as stiff.

From these facts it's easy to see that magnesium can do a thousand jobs equal to or better than steel and aluminum—and with appreciable savings in weight—whenever it's practical to increase section thickness. For more information contact the nearest Dow sales office or write to us: **THE NEW MATERIALS COMPANY, Midland, Michigan, Magnesium Department, MA 14000.**

YOU CAN DEPEND ON



EDITORIAL

Newspapers Discuss Secrecy Issue

Following are daily newspaper editorial comments on the case of government secrecy raised by the "off-the-record," behind-closed-door remarks about Aviation Week by Robert Cutler, Special Assistant to the President for National Security Affairs, and Lloyd Wright, who headed the Commission on Government Security (AW Nov. 4, p. 28).

Unfair

Washington Post and Times Herald

It is a good thing that the House Government Information Subcommittee is going to investigate the reported leaks made on the grid lines of Aviation Week magazine because it showed that the United States had been able to track Soviet missiles.

No investigation would have been necessary, however, if Robert Cutler, President Eisenhower's Special Assistant for National Security Affairs, had made no charges that he had to make on the record. There is something about secret materials upon the conduct of another that is repugnant to those who believe in ordinary standards of honorable behavior. Whose such secretions are supposed to be made open? It is particularly deplorable when persons exposing the amplitude of governmental power act about records of firm level against those with whom they disagree. Such tactics cloud the change itself in mysterious and deprecate the object of it all as opportunities to make an error.

Mr. Cutler is well known as an advocate of the most extreme kind of secrecy about government operations. Whether the national interest has suffered more from the public ignorance he has fostered or from the disclosure in publications he dislikes might make a good topic for debate. The secret of that dispute made, the only linear side course for Mr. Cutler was to put upon the record his secret and private counsel upon the good name of the object of a publication who had a much right as Mr. Cutler to discuss their operations for loyalty and patriotism.

Careless Use of Nasty Word

The Milwaukee Journal

The magazine Aviation Week reports that American today required in 1 order helps keep tabs on Soviet Russian missile launchings.

Lloyd Wright, who headed a presidential commission on government security, almost blew up over the disclosure he saw it as "smoking the circus." He seems to plan for the use he wants to read evidence to prove for disclosing government secrets.

Robert Cutler, President Eisenhower's assistant on national security matters almost follows the Soviet, into space is suspicious. He calls the report "shameful." Many who knew him speak freely, some of the nation's biggest scientists and defense producers the other day on that he called it "treason."

Why the blowup? Because, apparently, the American people were told a "secret." It is a secret everyone else knew, of course. The Russians knew it. The Turks knew it, but the American people didn't know it—ever, though it's their policy. And telling them becomes "treason." Apparently a person who gives a report of truth to the American people and business to detect their possible weakness under the mid-to-be late treatment of the Administration is a traitor.

This is pretty careless use of a nasty word like "treason." If it can be applied to those who merely say something the Administration would prefer not to be said, what strange enough words can be found to apply to some of the going on at Washington?

What word is strong enough to label our citizens defense "treason"? What word to describe the attack of our leaders to tell our people, friends, that have long been apparent to everyone else in the world? What word to label the conspiracy under which Administration spokesmen—sometimes including the President—try to cover up some of the hard facts of the world?

Truth, the chosen word to be, is a fine thing for us as one but dangerous. Doubt, in the face of the Administration, will decide what Americans can hear and what they should believe—and the gap will be widened with headlines from Alaska and reinforcements from Dick Island.

There will be and then if Americans stand still very long for the sake of thing.

Washington Calling

By Morgan Childs

St. Louis Post-Dispatch Syndicate

What Washington has above all, is a positive rather than a negative news agency. When Aviation Week magazine leaked the story of American radar lines in Turkey, their was indignation in the Administration, the Turkish being that even though the Russian knew this, they could now go to the Turks with an official complaint.

The dilemma is psychological rather than physical under a given handicap. It is not too late to accept the positive, but time is slipping by.

... Fears Public Disclosure

The Hartford Courant

Special Presidential Assistant Robert Cutler dismisses a secret relation from his superior. Mr. Cutler, on leave from a Boston banking post, handles a key role in the nation's security affairs. His reaction, however, to a secret magazine attack that told the American people something they had a right to know suggests that Mr. Cutler may have secrets of his own. He is, after all, a servant of the people even if he is entitled to special appointments and protected by a military security.

Mr. Cutler, experts have it, slipped violently to the disclosure by Aviation Week that the United States had a long-range radar set in Turkey, mounting Soviet missile units. The magazine disclosed its sources felt in making the news public. It proved its fact that the Russians were both aware of the act, and that the act was in the dark, even the American people. Most of all, they were warning that the Administration had much more information on Russian missile progress than it had allowed to be printed, thus

(Continued on p. 35)

In the Front Office

William A. Rappell, president and a director, The Radio Company, Inc., Pleasanton, Calif.

R. C. Keith, vice president, Aero-Machining Corp., and president of Aero-Cooling Division, Cincinnati, Ohio

Geoff C. Schindler, senior vice president, Electro-Intertec, Inc., Buffalo, N. Y.

Edward C. Bellows, vice president, The W. L. Mason Corp., New York, N. Y.

Robert W. Olson, vice president/research and engineering, Tecon Instruments, Inc., Dallas, Tex.

John E. K. Vetter, secretary of the Industrial Information Division (San Jose)

F. O. Roberts, vice president, General Electric Turbine Industries Division of Hartford, Conn.

Richard Gold, vice president, Kelen-Heyn Co., Detroit, Mich.

Sam North, Assistant Director, Electronix in Defense, Electronix and Defense Services Administration, U. S. Department of Commerce, Washington, D. C.

Charles H. Brown (USA, ret.), assistant secretary to the president, EMI Corp., Philadelphia, Pa.

Charles H. Skidgip, assistant vice president/customer service, American Airlines, Inc.

Honors and Elections

Frank Post, Jr., president of General Dynamics Corp., has been elected a board member of the National Industrial Conference Board, New York.

Paul B. Frost, chief of Bell Telephone Laboratories, Long Beach, Calif., has been named the 1975 Westinghouse Achievement Award for his article on coming fuel treatment of titanium.

Changes

George F. Ross, chief engineer, The Gas Corporation of America's Aviation Section in Los Angeles, Calif.

James F. Brown, manager West Coast operations, Good Supply (Shels) Distribution, Inc., Santa Monica, Calif.

John R. McKelvey, contracts manager, Los Angeles Division, Dyna Corp.

Robert M. Finn, manager marketing, Minde and Osborne Systems (Dayton, Ohio)

Conrad Kestner Co., Philadelphia, Pa.

Ray G. Williams, E. Ford (USA, ret.), manager technical assistance, Electronics Division, Scrimshaw-Corbin Division of General Dynamics Corp., Rockford, Ill.

William Kline, director of manufacturing, Mikropak Aircraft Co., Opaoka, Ohio

Robert D. Hanna, assistant chief of staff, Boeing Company

David B. Overbaugh, technical adviser for systems research, Rockwell, Inc., Miramar, Fla.

Thomas C. Hinkle, assistant, Schindler Instruments Laboratory of Rockwell International, Inc., Los Angeles, Calif.

INDUSTRY OBSERVER

Use of unarmored tanks left by seaplane aircraft and results in low frequency activities is being studied by Federal Telecommunications Laboratories under Naval Research Laboratory contract. Techniques utilize high electrical conductivity of these unarmored tanks. Problems in sampling to the tank is said to have been solved, but frequency range is not known. Present aircraft antennas decrease rapidly in efficiency below 100 m.

North American Aviation has been given to capsule configuration for high performance aircraft engine. Philosophy is based on F-104 long-range aerodynamic and WS-104A chemical burner design. Capsule member Goodrich configuration has been selected as North American design.

Range of 3,000 m. gain for California University's Oceanographic Digital Radar (OEDR) against environmental ballistic missile by USAF officials (AFJ Sept. 30, p. 25) may be an optimum condition figure with effective range closer to 2,000 m. Field evaluation of OEDR program as General Electric's missile detection system in Texas and Turkey is expected to provide detailed data on effective range under varying conditions and targets.

Major plant for North American X-15 high-altitude research vehicle will be a Boeing B-52. Indonesia may find it will be used to X-15, major missile trip inside his own nucleus rather than have contract, again in air.

Canada research vehicle currently fixed at Everett, but stability of the first per second supported by first stage cluster of four Thorol-Kanair rockets.

Allegiance Ballistic Laboratory has developed a solid-propellant rocket with an overall specific impulse of 235 seconds, about 40% better than most tests.

North American Aviation has advertised plans for production-type housing facility for student study and research in cooperation with the project for the WS-104A chemical burner. Swedish plans major role in design makeup of WS-104.

McDonnell Douglas test studies show that loss of the aircraft with 1.5-ton capacity can be turned inside a Lockheed C-130 without damage. Large 10-ton payload flying crane could be turned in a C-130 by being taken apart for loading.

At least two E-6B G36 (N36M-64) which North American Aviation was authorized to buy after USAF cancellations of the North American project have scheduled a range of about 100 m. against a goal of approximately 1,000-1,500 m. G36 (N36M-64) final North American which has been drawn, was to have been fitted with a three-stage booster developing 405,000 lb. thrust from solid-fuel core.

Designs Vanguard by Bellini-Rossan satellite launchings, project launches and test technical measures that are underway. Vanguard orbital system is one of the most sophisticated test. Guidance tested in Test Vehicle O, again table and third stage General Catalyst rocket engine tested in TV-1 and General Electric first-stage engine tested in second TV-2 firing all had high degree of success, although they were far from accurate. TV-2 firing is believed to be the first time a U.S. first-stage missile engine met its mission on its orbital flight.

North American's new converted North American intercontinental missile project made major contributions in state of the art. Among them, major design contributions in the conceptual phases of long-range vehicle development of extremely accurate guidance, design, development and construction of high thrust solid rocket and booster packages. Program has helped solve many of the very problems of bringing along a completely high performance nuclear rocket, which was developed in cooperation with General Electric.



Photo courtesy of Frank Bellows, Inc.

F8U-1 Corsair exhibits low drag to low drag in 3 down 25 minutes, photographing country coast to coast.

CHR seals assure top aerodynamic efficiency of F8U-1

Bacon covered silicone rubber airframe seals provide low friction, abrasion resistant surface, —100°F to 350°F flexibility.

Caps between moving and stationary parts of an aerial weapon system design that can accurately reduce aerodynamic efficiency. Sealing these gaps — aerodynamic sealing — is an important aspect of aerodynamic efficiency. Sealing these gaps also compensates for structural distortion in flight stream and production tolerances. Aerodynamic sealing is used extensively in Charles Vaughn's F8U-1. To assure optimum aerodynamic efficiency Charles Vaughn seals the gaps at the wing, fuselage, and tail, as well as those in the rubber CHR, produces these seals for Charles Vaughn and installed in their design specifically with material recommendations.

The F8U-1 employs seals are made of silicone rubber covered with Devcon fabric. They are flexible at extreme low temperatures, are stronger members and provide a low friction surface. Construction of these seals are finished and described in right.

CHR specializes in the production of non-metallic seals. Developing techniques to combine silicone rubber with such materials

as Teflon, stainless steel, aluminum, titanium and glass fabric and fiberglass-reinforced laminates. CHR has greatly increased the application range of the rubber. Examples of silicone seals are used in production in CHR, include:

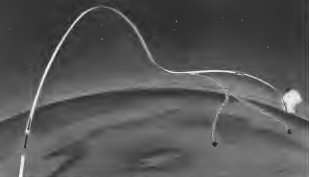
- Silicone rubber inflatable canopy seals
- Teflon covered silicone rubber canopy seals
- Fuel system seals, reinforced bleed silicone rubber seals for powerplant handles
- Teflon and fabric covered silicone rubber aerodynamic seals
- Modified silicone rubber canopy seals
- Reinforced and tapered silicone rubber canopy seals
- Enlarged modified silicone rubber canopy seals
- Fuel tank seals
- Fuel tank seals
- Fuel tank seals

Our experience in helping engineers with all types of aerodynamic and engine seals for —100°F to 350°F applications allows all forms of silicone rubber can be put to work for you. For design assistance and production requirements, write or phone CHR. Field representatives are available for direct contact.



Available on request to indicate and sample company engineers. Anytime and design CHR's 9 pages (last-section) show the basic and design and material recommendations. Write for copy.

CHR THE CONNECTICUT HARD RUBBER CO.
409 EAST STREET • NEW HAVEN 9 • CONNECTICUT
LOS ANGELES • ST. LOUIS • SEATTLE
Airframe Seals • Canopy Seals • Silicone Rubber Extrusions, Moldings, Sheet & Springs



TRAJECTORY ABOVE has been proposed to give manual radar planes measurement range or more. High velocity (above Mach 5) and high temperature outside indicates that a vehicle shaped approximately like an airfoil (but is more desirable for this trajectory than the conical shape which requires wings to lead. The X-45 research aircraft will follow a similar flight path over a much

shorter range. It is relatively low speed will enable it to pass through the radar's energy and guidance phase easily. With ICBM and IRBM weapons, launching, boost-out and reentry payload might not be kept low to prevent reentry heating and outside loads destroying warhead made of current materials. Once in the atmosphere the vehicle can maneuver to evade defensing assets.

Ballistic Missile Has Glide Potential

Doubled range for IRBM, ICBM evasion capability are possibilities drawn from data in NACA reports.

By J S Bats, Jr.

New York-New, more dramatic picture of ballistic missile warfare, a changing of data given in the behavior of hypersonic (above Mach 5, or more than 3,000 mph) vehicles.

Combination of shallow or low angle flight and reentry and glide techniques was called IRBM range from 1,500 to 3,000 miles and may make ICBMs capable of evading cruise above a target continent.

Missile Potency

Has new ballistic missile potency is based on these results of wind tunnel tests and theoretical analysis.

• Warheads with the general shape of conventional artillery shells are able to pull out of low angle ballistic trajectories to rise, reenter the atmosphere over at IRBM and ICBM speeds.

• These wingless, unpowered warheads can be efficient glide vehicles at speeds above Mach 5.

• Aerodynamic heating problems connected with the pebble and glide can

be solved with present knowledge. The enormous kinetic energy, which is dissipated in seconds during normal ballistic reentry, almost burning up a warhead, can be put to much more efficient use. A warhead could use this energy to pull out, glide and maneuver to extend its range for evasion.

Severe Problems

This is not to understate the problems of designing a suitable reentry and glide warhead. It involves an extremely complicated interaction of aerodynamic heating levels and rates, rates of the complete vehicle, rates, trajectory, payload, guidance, etc. However, the problem has been defined for some time and such warheads are considered feasible with today's knowledge.

In the U.S. study of the theoretical work with glide warheads has been done at the Ames Laboratories of the National Aeronautics Committee for Aeronautics. Dr. John Allen and Alfred J. Eggers, Jr., Ames Laboratory researchers, who played a prominent part in the effort to solve the problems of rapid reentry

along a true ballistic path, have also had major roles in NACA investigations of reentry and glide techniques.

These NACA studies are an extension and enhancement of the World War II reports by Eugen Sänger and Irene Bredt in Germany. A number of important suggestions based on this work for the Germans have been made in Wiesbaden studies by vehicles which can convert great speed into great range. Principal expert-comment on the Sänger-Bredt proposals has been a more detailed treatment of the aerodynamic heating problem.

Singer and Bredt as well as the original Sänger-Bredt studies at the Wiesbaden points are in view of the concept that the Russians have made of what Germans show it is not impossible to assume that they would attempt to improve the effects even of their ballistic missiles by developing the reentry and glide techniques.

The rate of these techniques will greatly complicate the problem of anti-missile defense, considered to be a very formidable problem under our current status.

Most suggestions for the anti-missile defense of the U.S. rely on establishing the trajectory and target of an eva-

tion missile somewhere between its maximum altitude and its impact point. Thus the rapid trajectory had been established before the target area would launch defense missiles based on the hostile warhead.

Anti-missile firing would probably be restricted to head-on angles because present computing and radar equipment is generally considered to be incapable of predicting lead data for side shots at a large number of targets with the rate and speed of an ICBM warhead. Without that lead data a high kill probability can only be achieved with a head-on attack and even then several defense missiles would probably be launched to ensure a kill.

Defensive Maneuver

To foil these defenses, there are now studies in ICBM warhead providing a head-on atmospheric attack by reentering the atmosphere several hundred miles from its target. Upon reentry, possibly over an ocean area, the warhead could change direction and approach the target at an altitude of less than 25 miles and at a speed of about 10,000 mph. The ability of this type of warhead to maneuver on its final approach in the target through the atmosphere could conceivably use plasma reentry to the point of impossibility for current radar, guidance and computing systems.

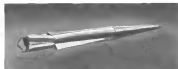
A report presenting the basic theory and discussing the present problems of hypersonic vehicles has just been released by the NACA. This report is titled "A Comparative Analysis of the Performance of Long Range Hypersonic Vehicles" and was written by Eugen Allen and Stanford B. NACA.

Reentry vehicles fall into three categories in speed and altitude.

• **Ballistic vehicles** which follow a parabolic path from launch to impact.



HYPERSONIC theory shows that vehicle reentry to the NACA suggests show how hypersonic vehicle might fly less than a flat plate above Mach 5. Reentry is provided by control fins on the bottom. Deflecting position of the fins ahead of the control. Nose is slightly modified to reduce heat during



ADDITION of wings will compound heating problems. Reentry control heat would go up, causing vehicle weight which again would increase heating, accelerating more control, etc. Total vehicle weight goes up markedly before the cycle is completed and in subsequent winged configurations is doubled.

• **Stop vehicles** which are launched along a ballistic path and upon reentry are then left to come down back into space in another ballistic trajectory. The path resembles a stone dropping over the earth.

• **Glide vehicles** which travel at best lift-drag ratio in the atmosphere. The NACA authors compare the efficiency of the three types by calculating the vehicle each requires to deliver a given payload over a given range. Total

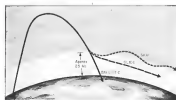
weight is an indication of system cost. The payload, structure, etc. of each vehicle was considered to be equal. Three general conclusions are that the ballistic vehicle was inferior to the other types in the sense that it required the greatest velocity at the time of powered flight to attain a given range. Increased velocity requires a greater total weight and consequently greater cost.

Efficiency Compared

The stop vehicle with a lift/drag ratio between 1 and 2 was found to be most efficient; thus both the ballistic and the glide types in conventional velocity range. However, it was considered to be substantially less promising than the others because of the aerodynamic heating problem and the loads associated with the stop.

The ballistic vehicle survives its reentry by employing a very blunt, high drag shape to expend a large portion of its kinetic energy at penetration drag rather than in friction heat. Glide vehicles are able to maintain a relatively low surface temperature by exhibiting a large fraction of their heat loss to the atmosphere even though they have a low pressure drag and create a larger amount of friction.

Linear travel in the atmosphere keeps the drag down from taking that much advantage of ballistic slowing. The surface temperature decreases.



RESEARCH GOAL is to prove ballistic with the stop or glide trajectories. NACA considers the stop path preferable with current knowledge and materials. Ballistic glide combination is possible at launch and reentry angles are low. The only range of ballistic flight but can greatly exceed total range.

Senators to Probe 'Entire' Missile Field

By Katherine Johnson

Washington—Congressional concern over Russia's satellite launching system destined to bring clashes with issues Administration leaders at Senate hearings scheduled to begin late this month under the chairmanship of Sen. Lyndon Johnson (D-Tex.), Senate majority leader (AW Oct. 14, p. 31).

Other members of the Preparedness Subcommittee, which will conduct what Johnson termed "a searching inquiry into the entire field" of satellites and missiles are Sen. John Stennis (D-Miss.), vice chairman, Sen. Edw. Kennedy (D-Tenn.), Sen. Stuart Symington (D-Md.), Sen. Byrd Bridges (R-N.H.), Sen. Leverett Saltonstall (R-Me.), and Sen. Ralph Yarbles (D-Vt.).

Indicators of the importance of this investigation is Johnson's decision to provide his first active committee participation since becoming majority leader. Other members of the Joint Senate Committee are being invited to take part in the hearings as co-official witnesses. These include Sen. Henry Jackson (D-Wash.) and Sen. Sam Levin (D-N.C.) who joined with Symington last year in a sharply critical evaluation of Administration developments in the satellite and missile programs (AW Feb. 4, p. 32).

"We must be faced to speed up satellite and missile programs. In most of the 1950 and 1960 target dates not indicated, we may have 1955, 1959 and 1960 target dates."

Technical Education?
Johnson will the coming session of Congress will consider legislation to "enhance" the education of both teachers and students in science and engineering.

Reduction Hearings
The subcommittee's attention will focus on the Army's missile program. It has been reported by Sen. Mike Mansfield (D-Mont.) Senate majority whip.

Johnson has announced that one of the first activities on the agenda will be hearings of Harbridge, the former of Army's Redstone Arsenal and Army Ballistic Missile Agency. Subcommittee hearings will be held later in Los Angeles and Baltimore, he said.

Highlights of Johnson's theme stems after a seven and one-half hour hearing at the Pentagon were:

- Russia is ahead of us. The U.S. is lagging in both the satellite and missile program and "could be caught by the Russians" if we do not speed the situation. Russia "has handed us both a technological and propaganda defeat."
- There is no sense in believe we cannot catch up—that is, if we apply the necessary determination, will power and money.

Apparently taking note of the Administration's "business as usual" approach, which has become increasingly unattractive in subsequent two sessions, Johnson added "But, it is clear a conservative approach to the space age will not guarantee American leadership. Russia's achievements are truly remarkable."

Johnson called for "bold decisions in our heads" combined spirit, persistence over our lagging program—because "great ideas are not produced in a vacuum." Referring to subcommittee members, he said: "We must be faced to speed up satellite and missile programs. In most of the 1950 and 1960 target dates not indicated, we may have 1955, 1959 and 1960 target dates."

Johnson's achievement are truly remarkable and technological skills that this effort. These are great implications in terms of satellite and missile development, but the most serious implication is what has left behind the state of Russian leadership.

Johnson and his subcommittee will be looking under a crash program "could rapidly become obsolete and another Major Loss." He added: "There is no immediate requirement for a launch of missiles to safeguard the U.S., but this is not a very important in producing a launch of missiles in the near future."

Johnson again emphasized that the subcommittee's attitude would be cooperative but significantly added, "We can be critical if criticism is needed as well as, at Defense Department or Administration leaders who have set prices on the missile-satellite program."

Pentagon Briefing
Sen. Richard Russell (D-Ga.), chairman of the full Armed Services Committee, and Sen. Storer Bridges (R-N.H.), the senior minority senator, attended the Pentagon briefing session in which Defense Secretary Neil H. McElroy, Deputy Secretary Donald A. Quarles and Gen. Nathan F. Twining, chairman of the Joint Chiefs of Staff, participated.

Presentations were made by Maj. Gen. R. J. Wood, Army Deputy Chief of Research and Development; Rear Adm. Ross M. Bennett, Chief of Naval Research; Robert E. Brown, USAF Assistant Secretary for Research and Development; and Brig. Gen. A. W. Berry, military assistant to W. M. McElroy, Special Assistant to the Secretary of Defense for General Motors.

The staff of the subcommittee has been gathering basic information on the satellite and missile programs since the Oct. 4 launching of Sputnik I. This along with a staff visitation, was presented to subcommittee members last week.

John Saltonstall is the only member of the subcommittee who has been in contact with the Administration officials behind the Russian satellite launches. Both of the other two Republicans have been in contact with the Administration's staff of agency (AW Oct. 13, p. 31).

Following the lengthy Pentagon briefing, Bridges reported that he is "deeply concerned with the overall progress" of the U.S. satellite launch program and called for the appointment of a "missile satellite coordinator," responsible only to the Secretary of



Russians Build 12-Ton Payload Helicopter

Two million cargo helicopters needed by Russia for the 40th anniversary of the Russian Revolution are on a U.S. test payload to an altitude of 7,500 ft., Soviet report. Russian reportedly carried 58 passengers in the new helicopter, the Mi-26, which is about twice as large as the biggest U.S. helicopter, the Sikorsky S-55, carries. Recent gross weight of the S-55 is 15,500 lb. From photos are clearly visible on the Russian helicopter. Part of what may be a Mi-26 is visible above the pylons behind the engine pylons. It is the four blades. U.S. helicopter experts who saw the Mi-26 photos did not dispute the Russian load figures, but were not sure how they had been obtained.

a return of the rocket to earth."

At first, according to the Missile Development Center, Hawthorne, ARS, N.M., compared reports received from Sputnik II with telemetry records made on intercontinental rocket flights in this country, but they had not yet deciphered the Russian code. This Navy official estimates it will take three months to decipher Soviet signals recorded from Sputnik II telemetry, which died three weeks after the launchings.

Soviet have not yet provided the key to the signal.

Scope of Russia's effort in the space flight field is indicated by the statement from Editor Vasily Zakharenko, in the scientific magazine *Tekhnika* Magazine.

"Thousands of people worked to build the V-101 jet transport, scores of thousands of people helped to construct our first atomic power plant. But it is impossible to measure the great mass of workers who have built the first satellite."

Soviet scientists also have been free with criticism of U.S. missile and satellite efforts.

Prof. Bregman was quoted as saying: "The rocket technology, the U.S. is not doing badly but it is far behind the U.S.S.R."

Prof. Bregman stated that Russia "has left the U.S. behind in the field of advanced, multi-stage ballistic rockets. The U.S. missile, which has been so widely advertised all over the world, have failed to pass the test and have not provided the return spent on them."

Dog Recovery Viewed as Feasible

New York—Chances of bringing the dog in Russia Sputnik II down to earth safely are fairly good to left of several U.S. studies. Suggestions for recovery satellite carrying living creatures have ranged from complete physical stages to helicopters with small strapping fast to round nose bodies with small wings.

Whether such satellites are approved or have small amounts of power for development and positioning purposes, the main requirement for successful recovery is a trajectory which carries a small angle with the horizontal. If the small angle with the horizontal can be maintained as the satellite descends the upper atmosphere, deceleration forces and aerodynamic heating can theoretically be kept within the limits

of human and structural endurance. One proposal by A. J. Egan of the National Advisory Committee for Aeronautics considered a satellite vehicle the approximate size of Sputnik II. The NASA vehicle would weigh 1,200 lb. and have a hemispherical shape of 10 ft. diameter.

Under such conditions with the low reentry angle this vehicle would expose one maximum deceleration of only 7 G's and the total heat that the deceleration would be more than 10 would be about 3 minutes.

Numerous capabilities under temperature of the hemispherical vehicle would be in the neighborhood of 7,500 R. This indicates that radiative cooling and the use of ceramic outer surfaces may be adequate for such a vehicle.

Defense and the President, to eliminate duplication and assure that all programs are pushed to a common priority." He said the launching of Sputnik II "should have stopped any remaining rank of complacency on the part of thoughtful persons" and that the Russian challenge is no dead end.

Hedges said the U.S. is "ahead" in the field of short-range missiles and that this, coupled with a ring of overseas bases, would thoroughly give the U.S. a superior military position. But he demanded "no ill-considered effort to overtake our position." He said that the congressional investigation "is the blame for most errors on any particular individual or group. We have no time to lose."

Mohr Vets Science

Meanwhile, there were those after Congressional developments.

House Appropriations Subcommittee on the Armed Forces headed by Rep. George Mahon (D-Calif.) expressed his confidence of the Fiscal 1959 defense budget each year by opening a check book investigation of the closed program with a review of the Via City General Air Sciences, co-managed by the USAF's Ballistic Missile Division, and Ballistic Air Sciences of Hughes, Calif., headquarters. Later, the subcommittee visited the Center for and manufacturing facilities of San Diego for the Atlas intercontinental ballistic missile, the Aerojet General Motors rocket boosters, and the Douglas Aircraft Co. "The first test site at Sacramento. The subcommittee plans a briefing session with McNamara and Quisenberry in Washington and members of the Ballistic Missile and Patrick AFB.

Staff of House Military Construction Appropriations Subcommittee headed by Rep. Carl Albert (D-Calif.) moved forward with a fact-finding study of network programs in connection with legislation to place civil defense under the Department of Defense.

Sen. Charles McNair (R-Mich.) urged the appointment of a subcommittee to direct research programs a proposal which also has been made by Sen. Kefauver and Mansfield.

Sen. Frank Church (D-Idaho) urged the launching of two satellites, "satellites" has been done to accelerate the defense program. With occasional intercontinental ballistic missiles "in the future, long-range missiles for coast-to-coast and programs for coast-to-coast forces should be ones of simultaneous attack or destruction."

Sen. Johnson said the use of Sputnik II and the defense it was provided from the earth gave us reason to suspect the Soviet Union has achieved nuclear rocket propulsion ahead of us.

In line with the still existing congressional demand, there were those who said:

House Civil Service Subcommittee headed by Rep. James C. Davis (D-Ill.) opened hearings on the "poor utilization of scientific manpower by Defense Department and the neglect and hoarding of engineers under defense contracts."

Davis charged at the beginning that the law streamlines the "almost as limited competition growing out of unbalanced defense dollars. It must not be allowed to continue if we are to win superiority over the Russians."

New USAF Funds Ease Cutbacks But Economy Efforts Continue

By Claude Witte

Washington—USAF and its major aircraft industry contractors, showed that money will be available to pay all accounts, bills to the next right month of Fiscal 1958, evidenced these efforts last week to contractors where possible.

With at least an additional \$100 million now available for Air Force procurement in the next six months (AW Sept. 8, p. 26), it was apparent that adjustments are being made in the area.

Contractors expenditure estimates in general have been covered throughout. This does not mean that all companies find it necessary or possible to reduce their estimated billing. But some were forced to adopt more realistic arithmetic. In view of this, the revised accounts that earlier figures were some what inflated.

Production schedules are being adjusted in some cases to make these costs conservative. Company representatives are also being called in by Air Materiel Command Headquarters in Dayton, Ohio, to consider objectives that will be acceptable both to the manufacturers and the Air Force.

Minor Adjustments

A USAF spokesman told Aviation Week that adjustments will be made and that there will be no change in the number of contractors for the single purpose of saving money. "Our only determination," he said "is to get ourselves out of the chaotic if it is there."

It was anticipated that the Dayton session will be finished by the end of this week.

In a telegram to 75 major USAF contractors, Air Force Secretary James H. Douglas said the industry could be undertaking the financing of new work-in-progress under complete contracts.

Sen. Wallace F. Bennett (R-Utah), former president of the National Union of Manufacturers and an Air Materiel Command spokesman on economic matters, declared that "the problem of keeping the dollar sound is now not as important as that of making research and perhaps more money available. We cannot permit the current news from Russia to serve as an excuse for fiscal irresponsibility. If we do, we are dead that we have irreparably damaged the basic economic strength of the nation, which, in the long run will provide the ultimate victory over world communism."

These actions, Douglas said—together with pledges of a continued economy effort—do appear that USAF will be able to pay its bills. Douglas expressed the previous expenditure estimates imposed on contractors about one month ago under the spending ceiling imposed by Charles E. Wilson, then director of Defense.

Research Reports

In the area of research and development where Ned H. McNamara, USAF's assistant, ordered reduction of at least \$170 million slashed off the available cash but defense contracts are being continued on a selective basis.

First priority is expediting the change to the research effort was given to contractors, many of whom had their programs severely spun off the start of the calendar year by military USAF cancellations (AW Sept. 16, p. 26).

A spokesman said last week that first of cancellations in the research area have occurred under of research, but that the task of reducing to the best possibilities and ordering work resumed should be handled in another couple of months.

The statement that not all contracts will be reduced, USAF will take the opportunity to drop work with contractors pending prospects at paying off in such information. On the other hand, it is expected that new projects will be undertaken.

Pratt & Whitney Layoff

Pratt & Whitney, Division of United Aircraft Corp., East Hartford, Conn., announced it will lay off about 500 of its employees by the first of the new Russian gas turbine P-3 engines. Pratt & Whitney Company president, W. H. P. Collins, said that with Pratt & Whitney at the end of the scheduled 1958 contract may be postponed until 1959. Collins said the shutdown is due to cuts in military aircraft production.

schedules, practically all of which were announced in mid-October.

Collins said employees for all of United Aircraft Corp. in 1958 will be at least as great as those for 1957 despite the adjustments in Pratt & Whitney schedules.

The Pratt & Whitney plant of 40,000 will be cut by about 1,000. But headcount will be reduced immediately. However, scheduled divisions will retain its present force of about 11,000, and include Aircraft Division will continue to carry 10,000 employees.

Medium-Range Circuit Transistors Developed

Dallas—Texas Instruments has developed two new devices that show medium power transistors to fill the gap between commercially available low power and high power transistors.

The new transistors will permit design of transmitter, modulator power sources utilizing these first built at 25C, one temperature and one built at 190C, one temperature difference ratings, according to Texas Instruments.

Both transistors have a typical average base resistance of 30 ohms at 25C, plus an operating range of about 0.6C to 200C. They are temperature stabilized at 25C. Companies and these different base transistors are all designed to high temperature working applications because of high peak currents resulting from one watt/50C dissipation and 10-ampere current ratings. One of the new transistors is a 60-volt unit and can be used with 25-volt power supplies used in various military aircraft. The other is a 100-volt device for use in higher voltage applications. The transistors have an inherent low-temperature rise in eight-volt minimum collector-base current and a typical static forward current transfer ratio of 30.

Boundary Layer Control Cuts F-104 Stall Speed

Boundary layer control the Lockheed Aircraft Corp. F-104 pipes high velocity air flow get caught into wing, where it is blown from stalled tube out over the upper surface of the wing, creating a wing flap. Use of BLC reduces F-104's landing or stall speed by 20 mph, cuts heading distance by one-quarter.

When flap angle passes 15-deg mark, automatic valve begins to open. Each open position at matched action flap is completely extended at 45 deg. Raising the entire 41-in. length of the flap, the BLC tube has 15 slots. Slots are placed 1/8-in. apart, creating a series of slots. Each slot is 9/16-in. deep and 0.35 in. wide. Air flows through slots and over flap at 2,500-1000.



Soviet's Develop Flashlight C

Flashlight C. Russian night fighter, according to believe to have advantages on its own jet engines for Mach 1 performance. Overall spec of the two-engine is 40 ft. Overall length 35 ft., gross weight 30,000 lb. Plans available equipment night fighter Flashlight C. Both planes are developments of earlier Soviet night fighter A.



Newspapers Discuss Secrecy Issue

(Continued from page 21)

leading to a grave surprise when Sputnik was unveiled. Mr. Carter got in a cloud meeting of business leaders but went and looked at the subject in his own way. It is reported that he gave quite a good and useful view of the situation. He also is said to have suggested relations against the magazine, though withholding of advertising was not his favorite. There are strong reports they are stronger when it is related that the so-called breach of secrets at which Mr. Carter takes offense is out of clear importance to the American people. That has been shown in the case of secrets since Sputnik in connection with that war, after all, and not only in the satellite field. Mr. Carter has a reputation for being in control and believing that secrets at the hot spots. Furthermore, United States Representative John Moss has stated as mandatory square rule just what Mr. Carter did say, and how it is revealed with a free government. It can't, Mr. Carter might remember these words of Thomas Jefferson, written long years ago when another government was also seeking withholding some information. You know citizens think they have a right to tell information, as a rule of such great consequence to them. It is their right which is to turn all the exposure of the war, and their blood which is to flow in evidence of the cause of it."

The Passion for Secrecy . . .

Los Angeles Courier-Journal

In the last ten years the House Information Subcommittee has done good work to restore the public's right to know how its business is being run. It has exposed shocking instances of the lawless or failed agencies to support administration and exposed how behind some helpful changes. But now the committee, under Chairman John E. Moss of California, has an even bigger mission to explore: That is whether government policy is to encourage publication by honest or secret dissemination of publications during its publication in the government's public to keep secret.

The first then that the question arises of all that is said to the government's policies for closed-door meetings at which public business is discussed. Robert Carter, White House press officer for the National Security Council, addressed such a meeting of businessmen at the Government Department's Executive Advisory Council. The press was barred, but many who heard that news shocked enough to talk.

Some of his listeners thought that kind Mr. Carter suggest an interesting thought of American Wicks. The trade publication which on October 21 reported that the U. S. has been leading Russian studies in special order response to Carter's home and Carter described the story to one of the most beautiful of military secrets in view, a "classified" disclosure. And so on.

The White House has several details of the basic question and quoted Mr. Carter's advice to being "classified" instead of "unclassified." But Chairman Moss very properly wants to get a full report of the going on at that stage by questioning Mr. Carter himself.

Whether the Information Subcommittee may discuss, one thing stands in plain. The government has no business withholding all the closed attack before an instance of transparency for the actual public presentation of American Wicks which a White House spokesman says is in progress.

Another result of the first response session is the large suggestion that American Wicks will "show" is a response of the fact that the government for more than two years has been suppressing knowledge of Soviet inside action concerning two years in which such suppression led the American pub-

lic to struggle with completely reported outbreaks in its own program.

As Editor Robert Moss answered when he published the story, on today's observation program was a secret from so not "except the vast bulk of the American people." The Russians, the Turks, and just about everybody else know about it, but not otherwise considered by other Working for reporters and suggested by the logic of circumstances.

If the government wishes to dispose these documents and to present American Wicks for an actual basis of security operations let it make it one in the court. In the meantime, no one knows that the same language of Chairman Moss's public will damage some Washington's secret triumphs, as he has decided it, to and put a secret stamp on everything—especially on everything that ought not to be secret.

And if any more publications are to be started, let it be in public assistance and legal assistance, not in secret dissemination before dissemination leaders who might not even need to hear the word "secret" before deciding that doing business with the publication demanded would be poor business policy indeed.

Leaks vs. Light

Los Angeles Examiner

How far should the government go in withholding information from the American people in the interests of security? This question has been asked since in Los Angeles, a post government of the American for Americans who looked the Government in Government Secretary.

Wicks has urged amendment of legislation which would permit with fines and/or prison terms, newsmen and others who disseminate government secrets. The bill, the American Security for Industrial Security, meeting in Washington, that he had been asked to legislate will be "one of the first orders of business" when Congress meets in January.

The real test of this issue is, of course, who shall be called an "accident."

Bureaucrats say all too prone to "classify" information which the people have a right to know.

Sometimes it's merely a case of petty officials playing safe. But the security label also can be used to cover up serious mistakes or errors.

There have been a few exceptions, but by and large the American press has an admirable record of cooperation with the government when national security needs it reported.

Legislation which would punish newsmen for revealing information which was thought by government officials labeled "secret" is a dangerous infringement upon the people's right to know.

To start off revealing "secret leaks" in the manner of too often occurs in shutting out the light by which the American people can see what their congressmen in the federal government are up to and how they are spending their money.

That is the way to achieve greater security which is created by the safety of the nation, but the way is an unbridled transparency which is observed in the nation's best news of freedom.

. . . Revealing Secrets . . .

Dallas Morning News

A dispatch from Washington says that a bill will be introduced in Congress providing fines and imprisonment for

newspapermen and others who reveal government "secrets."

Lord Wright is a civilian head of the Commission on Government Security which has been studying the problem.

American Wicks magazine published a story claiming that the United States has sent some 500 million copies in Turkey, including several billion in Russia.

"I suspect that someone would not think some clarity of the penalties of revealing the crime before publishing that type of thing," Wright said.

But when did American Wicks get the story? Somebody in charge of Mr. Taylor, who said something there is copyrighted all materials, the who typed all materials also who typed off the magazine.

American Wicks cannot have newsmen all over the world. No newspaper or publication can. In revealing "secrets," the government itself is the worst offender, and the revealing of those often is paid in one or in one branch

News Digest

English Electric F3R interceptor has been flight tested successfully for the first time with its modified variable-angled missiles with which it will be equipped. The test was reported to have been satisfactory, with an above average in F3R performance, at high speeds. The aircraft was decorated close to the fighter's fuselage on each side of the nose.

Lockheed's Missile Systems Division, Palo Alto, Calif., is using a 10-ft. shock tube to test advanced designs of the Navy's future ballistic missile. Ten pressures and pressures generated with in the tube will simulate those of a long-range ballistic missile would encounter in flight at speeds of 15,000 mph.

New order to Navy Cut CT-30 target missile has been placed by Robert Murphy, Navy Secretary, to be replaced by a new Navy target.

Henri Poincaré, aviation pioneer and head of the French aircraft firm which bears his name, has produced continuing interest in Air Force, leader of the Magasin jet business. Air Force's French venture was greatly over by first French aviation companies.

French have fast reaction time under belly of delta-wing Gerbier experimental interceptor at supersonic speeds, say tests are probably first of their kind to be conducted in Europe. Experiments are being made at Onera.

Japanese Government approval of a technical tie-up with Canadian A.G. of Saskatchewan has been required by Mitsubishi Electric Manufacturing Co. The agreement valid for 11 years would cover the domestic manufacture of Delvite ground-to-air guided missiles and being control systems for anti-aircraft guns.

of the industry trying to show its superiority over the other.

But all kinds of media, to avoid stricter regulation should receive greater judgment. Freedom of news and speech are issues only of the country is secure. Distortion of that security is destruction of all its freedom.

In wartime voluntary censorship worked well. Penalties were high, of course, at times in the face of pain.

The danger of a law being and exposing reporters who reveal "secrets" is the government's inability to defend secrets. The 3,500,000 Russian and communists in the federal government constantly will adapt the state of its secreted information, until security on the secret state will be considered a secret. We will have government in blackout. The first step toward security is the defense forces to protect their own secrets. The next step is for all freedom to exercise care and caution, remembering that all freedom can result with military education.



Flatcar Is Atar P3 Test Rig

Latest version of American Flying Atar, the Atar P3, is being run on a railway flatcar for tests to determine effects of reduced wind flow on the jet engine of the VTOL, which Atar will be mounted horizontally below powered locomotive. Jet exhaust directed in direction of train movement will simulate conditions of vertical descent. French State Railways are operating in tests, which will utilize straight track at track in Males, near, near Paris. Each test arrangement, needed in other and covered within are described P3 will be test first only in vertical flight, but P3 also requires will begin operation. Vehicle was built formerly on Atar B1 flatcar (AW Aug. 6 p. 10).

AIR TRANSPORT

Airline Earnings Point Toward New Low

Industry profits show sharp dip in third quarter; earnings for 1957 may fall below \$50 million.

By L. L. Doty

Washington—Airline earnings for 1957 appear bleak for the lowest level in three years. Profits continued to drop sharply during the third quarter of the year despite a modest increase in passenger revenues.

An American-Wayne survey of domestic airline activity during the 12 months ending Sept. 30 indicates net profits for 1957 may fall below the \$50 million mark for the first time since 1953. Estimated profits for the 12 months are \$46 million, compared to an actual net profit of \$19 million for the same period of 1956.

Furthermore, although estimated revenues for the 12 months ending Sept. 30 indicate revenue growth is continuing to follow the healthy development pattern of the industry, passenger traffic during October fell short of forecasts. Should the downward trend in passenger traffic continue through the winter months, an even deeper depression in earnings can be expected.

Despite current records for the industry was established in 1955 when the domestic trunkline carriers reported a net profit of \$65 million compared to \$71 million in 1954 and \$57 million in 1956.

Passenger Increase

On the strength of the present survey, a 10 to 12% increase in passenger traffic can be forecast for the year. Although this volume is comparable with a long range forecast of 5 to 12% only year during the next five years, it is substantially below the 16% gain anticipated during the past five years at the 25% increase recorded during the 1948-51 period.

Operating expenses showed no signs of slackening during the 12-month period, indicating the airlines are getting no relief from the profit pinch which has plagued the industry since the fall of 1956. Of the big four airlines reported by News World, Airlines reported an estimated decline of the mounting expense level. It amounted a decline in the clutch of costs per available seat miles during the last nine months of the year.

Estimated operating expenses for the domestic industry during the 12 months covered amounted to \$1.5 billion as compared with an actual \$1.1 billion in

the 12-month period. Operating costs amounted an estimated \$1.4 billion against \$1.2 billion in the same period last year.

Operating Revenues

Longer index in ticket sales is one reason of rising a sharp focus on the airline financial picture, operating income during the third quarter of 1957 is shown to be almost one-half that reported for the third quarter of 1956. On the basis of a 1956 volume index of 268, operating income during the quarter climbed 314 in 1956 and to 157 in 1957.

Operating revenues climbed from an index base of 140 in the third quarter of 1957 to 199 for the same period in 1956 and 175 in 1957. Operating income, however, dropped sharply from the 1955 index base of 78 in 1956 and to 57 in 1957.

During the last eight months of the year, available seat miles rose 16.7% as compared with a 12% increase in 1956. Declines in new equipment during the next months may bring this increase to a high as 25% in 1958 unless retirement of old equipment is accelerated to a higher rate than has been experienced in the past.

Actual passenger revenue per passenger mile averaged 5.27 cents during the first nine months of 1957, compared to 5.24 in 1956. The trend in this category has been consistently downward since 1951 and a possibly the direct result of the steady growth in aircraft service.

Fare Increase

Airlines recorded the decline in the average passenger revenue per passenger mile a significant sign that a fare increase is needed as a key step toward restoring sufficient revenue increases at a pace of least equal to expense increases.

That the mounting public cost both the need for a fare increase as a means of meeting a new sell on common stock is underlined by the sharp rise in volume stock prices on the New York Stock Exchange 10 days ago when sales jumped through Wall Street that God Associates' board stockholders were suggesting a higher rate of return for the common.

For the first nine months ending Sept. 30 Texas World Airlines showed a substantial improvement over the same period for 1956. Net income climbed to \$7.4 million compared with earnings of \$4.1 million through the third quarter last year.

Net income before taxes this year was \$16.6 million of which \$16 million was from transport operations and \$1.6 million from other activities. This airline's international division reported a \$2.6 million profit before taxes in 1956 compared to \$51 million, compared to a \$1.2 million profit generated by domestic operations from gross revenues of \$14.8 million.

TWA's cash per available seat mile was also ahead from 25.4 cents in 1956 to 28.3 cents in 1957 as domestic revenue per mile rose from 45.3 cents in 1956 to 44.3 cents in 1957 on international routes.

Recorded Traffic Growth

Currier-Burgess, TWA president, emphasized the value of the industry traffic volume to meet expansion and set standard traffic goals was reflected in September results when earnings before taxes climbed 28.7% to \$1.9 million in September 1956 to \$3.3 million for the same month in 1957.

Capital Airlines also reported that its first year with operating revenues per available seat mile rose from 5.27 cents in the same month of 1956 to 5.24 cents in 1957. Operating revenues totaled \$45 million in compared with operating expenses of \$27 million for the first three quarters. Operating expenses climbed to \$69 million and expenses reached \$68 million.

The carrier landed at three quarters operating loss of \$3 million in 1956 and a profit of \$1 million in the third quarter of 1957. Net loss was cut from \$2.8 million in 1956 to \$1.7 million for the third quarter of 1957.

Eastern Air Lines reported a sharp decline in profits for the first nine months of 1957 although operating revenues had an all time high for the carrier. Operating revenue of \$21.7 million during the period showed a 25% decline in earnings.

Loss factors dipped from 62.70% to 61.85%.

Eastern pointed out in its third quarterly report that rates were up 76% over the first nine months of 1956. Fuel costs increased 15%. Total net earnings for the airline rose \$4.4 million but the net month period compared to \$11.3 million in 1956.

United Air Lines had its own month record gain during the first three quarters of 1957 by more than

\$14 million, but net earnings dropped from \$30.1 million last year to \$8.1 million this year. Operating revenues climbed from \$320 million during the nine-month period of 1956 to \$311 million for the same period this year. Its passenger net was \$178 million to \$209 million.

United's third quarter revenue per passenger mile climbed 12.9%, but total available seats jumped 13% during the same period.

During the first nine months of the year, United added 37 new four-engine planes to its fleet.

Delta Air Lines reported a passenger ticket volume of 13.77% during the September quarter—first of the airline's current fiscal year which ends June 30, 1958.

The airline, however, recorded a 18.6% increase in operating expenses for the three months period. Net income for the period was \$156,680 as gross revenues of \$18.5 million, an 18% increase over the corresponding period in 1956.

Reduced Earnings

American Airlines reported a big decline in earnings from \$17 million during the last month of 1956 to \$10 million for the same period in 1957.

Net earnings per share of common stock including profit on disposal of property dropped from \$2.13 to \$1.25 during the two periods.

Total revenues increased from \$217 million in 1956 to \$231 million this year.

Expenses climbed from \$231 million to \$223 million. During the same month period, American earned \$132,671 passenger a total of 39 million over passenger miles of 4.75, as compared to the 6 million revenue per passenger for the same period last year.

The airline moved \$4.6 million less in net earnings during the first nine months of the year, an increase of approximately 24.6% over the same period last year.

Mailroom Success

Norfolk Air Lines indicated a modest setback for the first nine months as the result of a jump in gross expenses from 57% increase in the 1956 first nine months to \$11.3 million this year.

Net loss for the first nine months of this year reached \$2,268,465 compared to a \$66.17 loss during the same period last year.

Revenues were up to \$11 million from the 1956 figure of \$7.8 million, but the airline began to feel a traffic slump in September. The Washington-based carrier dropped to 42.57% from 51.99% in August and from a \$7.73% figure in September, 1956.

Fare Probe Begins Next Week; Domestic Lines Renew Efforts

By Paul Eastman

Washington—Domestic trunk airlines will soon start efforts to find Monday when hearings begin in the General Free Investigation to prove that the airlines need a fare increase despite a favorable past earnings record.

Airlines say a fare hike is necessary because costs are mounting faster than revenues, lowering profits and reducing chances of obtaining the Federal Reserve backing necessary to move into the pit. Rate increases will be in various carrier ranges from 5% to 20%.

Difficult Task

The task is not expected to be an easy one. Civil Aeronautics Board has based its decision on the basis of the level of earnings reported by a fare hike which is a reasonably extended period involving both paid and lost costs. The railroad used to measure its earnings on the basis of its own ratio on investment as applied to domestic rate proceedings.

Called as average past earnings have been used in the past, the board will now look into the record. The average rate of return for the 12 trunklines from 1946 through 1956 was 11.67%, according to the Board. The 1955 average rate was 11.85% and the 1954 average was 9.42%.

Called as average past earnings have been used in the past, the board will now look into the record. The average rate of return for the 12 trunklines from 1946 through 1956 was 11.67%, according to the Board. The 1955 average rate was 11.85% and the 1954 average was 9.42%.

Best Years

The years between 1950 and 1956 are generally considered the best case for the airlines since the last case was based on the basis of a financial standpoint.

Although the Board took notice of declining profits last year and this year, it concluded that on the basis of the record the present depressed earnings appeared due to short-term factors. It said an airline had been subjected to these factors could not cope with the downward trend in profits.

Throughout the agency that accompanied the decision, CAB apparently pointed out that it cannot rule out of substantial arguments it could take into consideration in determining the rate of whether present rates was an adequate or not. Among these were: (1) the airlines' claim that the current fare had substantial erosion in the past; and they have not established the economic and operational factors—

which in the past afforded opportunity for reasonable increases, such as economic and efficient management, can be obtained in the future.

• There is no evidence that a fare hike rate of return was adequate in the past, even if the airlines had evidence on the record supporting a different rate of return. The position of the carriers is that they are seeking a dollar amount of earnings for the Board to consider in its decision, without advancing any particular rate of return.

• Main argument advanced in this proceeding in support of the previous rate increase can no longer be obtained in the past. The non-increase proposed would be more costly than their present position. However, no carrier other than United has indicated any intention to support the proposition.

• Most of the carriers contend that the best of these is the requirement that earnings be kept at a reasonable level in order to maintain a certain level of service. However, the carriers are not expected to support the proposition. The difficulty with the claim is its lack of adequate support. There is no direct or indirect evidence on the part of the trunkline industry generally to obtain accurate financing for replacement or expansion. The industry was affected from members of the financial

Capital Wants Subsidy

Washington—Capital Airlines said the Civil Aeronautics Board last week for a series of airline protests to permit it to operate in unprofitable areas at a loss of \$75 million. The airline was not allowed from subsidy payments in October 1956.

In a petition filed with the Board last week, Capital asked for subsidy payments of \$67.5 million per year per airline in addition to the normal amount it now receives. The carrier said it was faced with an operating situation and declined its ability to operate without subsidy because of a recent financial condition.

Capital said the Board it would receive an annual \$2.5 million per line in 1956 on average of \$77.5 million at the present rate of subsidy. It added that 1957, per annum, which the airline described as a "very dark possibility." The carrier said it was faced with a profit of \$116 million gross revenues.

community is to the level of earnings the carriers would require in order to obtain additional financing.

Hester's Stand

Based on Martin Louis J. Hester, who filed a separate concurrence, summed it up this way:

One aspect of the case seems to me of particular significance. "The carriers' case for its emergency measures is based in large part on the claim that passive prevention funds do not produce sufficient receipts to enable the carriers to make the capital expansion, but that per-emptory programs...

Yet the record, in my mind, contains little real evidence on this subject. In general, the carriers' case on the supported members of their own carriers that an immediate loss in income is necessary for them to complete their equipment financing programs...

From its response, the Board left little doubt what it really meant: present in the way of evidence to justify a loss in income. Hester was asked some questions. He said that if a carrier cannot be justified in order to finance their equipment programs, the Board must require convincing proof that these programs are reasonable and economic.

only and financially feasible.

It seems to me," he said, "that a convincing presentation of the carriers' emergency programs and their related financing needs would require something like the following:

- Language table projections, including time schedules anticipated from the introduction of jet aircraft.
- Detailed purchase and disposal programs related to introduction of jets.
- Financing plans necessary to cover peak periods of needs.
- Rate of return on level of earnings necessary to accomplish financing.
- Financing plan levels necessary to achieve the required rate of return.
- Evidence that the proposed measures are compatible with the traffic programs with which the planning begins.

From exhibits already exchanged in the General Passenger Fare Investigation it appears that the carriers are not the only parties who are concerned with considerable written testimony from financial experts regarding airline financing.

Other Issues

Other issues or questions that will appear during the re-examination include:

- Accounting procedures. An updated airline expenses in line with the work study used by the CAB is the particular issue pending to determine "passable expense?" In the past problems of deficit of approved airline expense have been identified by the CAB as not pertinent and not representing efficient management. Increase of all expense, whether justified or not, would tend to depress profits reported by the carriers.
- Profits reported by airlines also will be affected by method used to depreciate equipment, depending upon the life allowed for the aircraft and the residual value. The CAB said in its 6/15 case, submitted a method that allocated greater profits than the airlines reported.
- Carriers also contend that, in ac-

counting the adequacy of their earnings, capital gains should not be taken into account since they are subsequent, non-recurring and not income in the ordinary sense. Instead they must be charged back into some equipment.

The Board said that arguments for jet aircraft in the 1970 case, but that it might have, as the accounting.

Airlines have contended that equipment deposits should be a part of the investment loss. Board Counsel then stated that in the 6/15 case, by including equipment deposits in the investment loss, the rate of return would be decreased unless offset by an increase in profits.

"Carriers would like to figure out costs on the basis of available jet aircraft instead of equipment. This would reflect in the showing of higher costs and depressed earnings in this case."

Airlines contend the correct drop in fuel factors in fact is increased corporate taxes from recent state assets and will not expense. CAB admits no competition, particularly in the retail price, private airline management with private scheduling problems. It adds, however, that this is a temporary condition and can be overcome since a rational fare adjustment mechanism to determine the needs of the market.

Airlines insist on use of equipment at the cost, as in the services. For example, CAB probably will want to know if profits are being depressed by large trucks serving two main of the short haul markets or by adding equipment that is unnecessary in a certain market. Considering the relatively high rates of selling and handling traffic, the Board said, length of haul is a major cost factor in a carrier's earnings potential.

Another question that may be used of airlines, and one which the carriers would probably not like to answer, is: How long have they been flying a loss year, what has level will be necessary to present an adequate return on a long term basis?

Another question that may be used of airlines, and one which the carriers would probably not like to answer, is: How long have they been flying a loss year, what has level will be necessary to present an adequate return on a long term basis?

Chicago-Miami Route Proposed For National in Great Lakes Case

Washington-National Airlines was recommended last week to fly the direct Chicago-Miami route. CAB Administrator Board Member William F. Conrad, Delta and Capital Airlines also were recommended to serve additional markets on the Chicago-Miami route.

In his statement of the long and involved Civil Aeronautics Service Case, Conrad selected National over several other applicants, including Capital, Capital Airways, Trans World and United

The case covered a number of applications for service in a bid to fly the direct Chicago-Miami route. CAB Administrator Board Member William F. Conrad, Delta and Capital Airlines also were recommended to serve additional markets on the Chicago-Miami route.

There were 10 applicants in the case, five carrier submissions, 11 civil aviation, and 17 passenger. Trans World and United Airlines were the lastest in the



Russia Unveils Huge Tu-114 Turboprop

New Soviet aircraft the Tu-114 Boris, is powered by four turboprop engines capable of approximately 12,000 shp. propellers of the Boron bomber. Aircraft, Russian say, is equipped with two elevators, telescopic system and 45-seat restaurant. Moscow News York reports performance with 770-110 passengers at 910 mph, cruise is claimed for the aircraft, designed by group headed by A. N. Tupolev.

designers constructed 350 pages in addition to eight pages of tables. Conclusions recommendations are:

- Certification of National Airlines to operate between Chicago and Miami via Indianapolis, Louisville, Knoxville, Atlanta, Tallahassee, and Tampa (St. Petersburg), Charleston, with a return route that Atlanta be served only on flights operated between the terminals Chicago and Miami.

- Extension of Delta Air Lines from Cincinnati to Detroit via Dayton, Columbus and Toledo and the extension of Tampa (St. Petersburg), Cleveland and Detroit via intermediate points on the route between Miami and Jacksonville, with a restriction prohibiting international service between Cincinnati and Detroit. Also the extension of the same route from Knoxville to Charleston.

- Extension of Capital Airlines from Pittsburgh to Buffalo via Youngstown, Akron, Canton, Cleveland and Erie and from Atlanta to Miami via Jacksonville, Tampa (St. Petersburg), Clearwater and West Palm Beach, with a restriction prohibiting operations between Erie and Cleveland except on flights also serving Atlanta or Miami.

Rostodyne's First Flight

London-Paris passenger Fieser Rostodyne, designed in a V100, transport, made its first flight last week at Wakefield Airfield. Flight lasted 28 min and was piloted only Rostodyne has found wing not critical.

and with a further restriction prohibiting international service between Atlanta and Miami.

- Extension of Eastern Air Lines from Charleston, W. Va., to Chicago via Cincinnati, subject to a restriction prohibiting flights between Charleston and Chicago that do not originate or terminate in Charleston, S.C., or points north. Also, extension of Eastern from Louisville to Detroit via Cincinnati and Fort Worth subject to a restriction prohibiting international service between Detroit and Cincinnati.

- Extension of Trans World Airlines certificate to include the international restriction prohibiting international service between Chicago and Washington and to remove restrictions prohibiting service between Cincinnati and Indianapolis.

- Extension of United Air Lines certificate to include a flag-haul restriction prohibiting international service between Chicago and Washington to authorize service between Chicago and Washington via Dayton and Columbus.

- Extension of Northwest Airlines certificate to include international operations between Detroit, Cleveland, Pittsburgh and the terminals Washington and Baltimore.

Russia, U.S. Dispute Bilateral Progress

Washington-State Department last week denied that discussions with the Soviet Union on a bilateral air agreement had begun, although an official of the Bureau contends that Aviation

Week "negotiations are now under way."

A State Department official said the Russian proposal for an agreement with the U.S. was submitted in part of a document program covering areas and means of expanding the exchange of ideas between the two countries (AW Nos. 4, p. 41). He said, however, the program includes some 50 separate items and added that Russians have not touched on the bilateral proposal nor have they backed their plan to discuss it. Discussions on the first air agreement were started last Monday.

The Soviet proposal was regarded that the proposed air pact would soon be submitted but refused to elaborate on any of the details of the plan.

Meanwhile, Pan American World Airways, which holds operating rights to Moscow and which once was refused by the State Department to negotiate with the Russians on an air agreement (AW Aug. 27, 1956, p. 25), had remained an official or unofficial flight last week, from either the Soviet Union or the U.S. that bilateral discussions are imminent.

New Comet Planned

Hawthorn, England-De Havilland Aircraft Co. plans another version of its Comet 4 jet transport, to be known as the Comet 4E. Designed for operation over intermediate stage lengths, it is expected to provide similar the payload of the Comet 4E with enough stage length occupied by 300 in Comet 4E has been dropped.

THE RECORD-BREAKING VISCOUNT



BEA reports...

VISCOUNT FLEET MAKES PROFIT OF OVER 3 MILLION DOLLARS IN ONE YEAR!

During the 1955-56 fiscal year British European Airways' fleet of jet-prop Vickers Viscounts operated at a clear profit of \$3,150,000—on 965 profit per flying hour for each Viscount. And during this same period, BEA's competitive position was greatly improved. On the Great Britain-Europe service—specifically Viscounts—BEA's share of traffic rose to 95% while the number of passengers carried increased 18.9%.

BEA comments, "The Viscount has opened high profits from passengers, crew and ground staff alike. The Viscount has shown remarkably superior to that of any previous new BEA aircraft, an introduction to full service."

Smaller markets are reported from all of the 37 other airfields throughout the world which are now flying Viscounts. Many evidence that "wherever the Viscount flies, traffic follows suit."

JET-PROP VICKERS

VISCOUNT

POWERED BY FOUR ROLLS-ROYCE DART ENGINES

G. G. Representative: Christopher Clarkson,
20 Rochester Place, New York 20, N. Y.

SHORTLINES

► **Elmley Air Flight Corp.** reports a record net income for the third quarter of 1957—\$181,691, equal to 26 cents per common share. Third quarter net income rose from \$2,446,626 in 1956 to \$2,082,136 in the third quarter this year. Net income for the nine months ending Sept. 30 was \$540,827.

► **Trans World Airlines** closed a new on-day second class New York to London-Gateway A TWA Lockheed 1049 Constellation made the trip in 10 hr. 15 min., cutting 15 min. from the record set by a Lockheed Super-C Constellation last Jan. 19.

► **Harvard University School of public health** in Boston is conducting a post graduate study in aviation health and safety. Study was made possible by a \$150,000 grant from the Daniel and Florence Guggenheim Foundation in New York. There are 15 persons enrolled in the course, including military and civilian physicians and engineers from several airlines.

► **Scandinavian Airlines** System is adding more new aircraft buses, between New York and London. Daily Viking flights from New York to North Atlantic flights and San Francisco to San Francisco flights. The new services include night flights, gourmet meals with Swedish central Danish specialties and wine, coffee, comfort seats and sleeping berths. Sleeping berths will be provided in new for the morning alone, new of luggage will be provided to all passengers.

► **Providence Boston Airline** reports its 1957 traffic figures were 4670 above 1956 operations. The local airline began its 1957 season on May 17 and completed it on Sept. 29. It has 8,626 passengers on 1,515 flights over its route. During the season only 25 flights were cancelled due to bad weather. PBA also earned 3,257 lb. of cargo from Providence to Boston 615 lb. was carried outboard.

► **British Overseas Airways Corp.** has become world wide again for Hong Kong Airways (BOAC) will handle all routes for the airline.

► **Quaker Airways Ltd.** has flown the first one stop flight from Honolulu, T. H., to Sydney, using a Lockheed Super-C Constellation equipped with special wing tip fuel tanks. The Constellation made the 1,175 mile flight in 22 hr., 34 min. Average speed was 210 mph.

AIRLINE OBSERVER

► **Watch for increased emphasis on aircraft handling and shipboard techniques in competitive battle for dividing water traffic routes and their use.** Added competitive schedules in profitable routes are being entered to take over routes that will protect a line of potential transoceanic routes because of low speeds, unimproved techniques and low fuel efficiency rates. Chief passenger complaint now is against being asked to wait in a hold for a final flight and a crew member is less likely to handle the request. Problem has been compounded by high volume of calls from passengers seeking to cancel reservations in accordance with the no-show penalty requirement.

► **Airlines do not appear to be at a loss for words in explaining the reasons why they believe they should be an extension of air law.** Exports and written testimony exchanged in the General Passenger Fare Investigation is far more than three feet high.

► **There is a potential factor most strongly associated with air travel according to a scientific research survey, conducted by the National Institutes of Health, University.** Employing a new technique of social and clinical research the Tufts group found that air travel is associated with a variety of factors, but by anxiety, nervousness, depression, and sleep. On the other hand, air travel is associated with less fatigue, less depression, less pleasantness, and a "slight headache." Persons interviewed for the survey had traveled at least 200 mi. by either air or rail within the previous year.

► **Flight Engineers' International Assn., AFL-CIO,** is fighting an independent union's attempt to win negotiating rights at United Air Lines. The new union, United Flight Crew Members Assn., has a petition with the National Mediation Board to conduct a union election in its first year to gain ownership over the FAA, and AFL-CIO affiliate. National Airline, FAA now represents 648 flight engineers or about 90% of all U.S. engine crew members.

► **Independent Airline Assn.** has filed the U.S. Circuit Court of Appeals in New York to sue the airlines against the Federal Aviation Commission. The suit charges that the airlines have been discriminating against the independent airlines by the Federal Aviation Commission. The suit charges that the airlines have been discriminating against the independent airlines by the Federal Aviation Commission. The suit charges that the airlines have been discriminating against the independent airlines by the Federal Aviation Commission.

► **North Central Airlines** shareholders have approved a stock split plan that will increase authorized common stock from 718,000 to 1,350,000 shares. Under the plan, each share of the airline's present stock will be exchangeable for five shares of the newly authorized stock.

► **American Airlines** is planning a seat configuration on its Boeing 707 jet transports of 140 seats for coach flights, 100 for first-class flights. First-class configuration may include less about seating arrangement in every other row allocated with rows of five about seating.

► **Airlines will cancel Christmas gift express this year** as a direct result of increasing costs. Capital Airlines has told employees that the Christmas fare holiday which the airline has been charging every holiday season since 1951 is less of Christmas Cards will not be available this year. Eastern Airlines also has told employees that company-purchased cards will not be delivered this year.

► **Trans World Airlines** will hire at least 48 British girls for London training this winter. A selection board of six TWA personnel experts were in London last week interviewing applicants.

► **Northwest Airlines** has petitioned the Civil Aeronautics Board to intervene in proceedings over the Airline Wages. The Airlines proposed to acquire 125,000 shares of Philippine Air Lines stock.



William Byam, The Mexican Climate
 "Tipping a little feeling [sic] a conversation
 a series of travelling have been to
 there is an unfavourable place here
 though the climate is thousands of
 miles. Since the Texas fight is stopped
 because, no doubt would a tropical
 zone of no-sunshine is possible, visit
 of this built along the north."



Waters and Michael Vangelis, mother team—Tina is the 70 and 140 lying through no means. It's as if you were moving through something that really is a lot more—as a substance, it's more like a very thick and smooth. It's as if you were told something as a book, not just as a. The book is more and more, it's a book, it's a book, it's a book.



Albert E. Hughes, *The Christian Science Monitor*: "If Americans really and truly are serious about the fight now underway to get gays, let them tell it to the public. High quality, accurate, as-physics-as-is has marked this movement, with a mix of both of science, with different from movement, and."



Leslie Lewis, Chicago Daily News: "Taking off a thousand T's is a stream-line thing. No more of engines, when I'm on previous changes. The cost starts at \$1,000 but it's off-line. You start along like an arrow, get what is complete gone. This is really useful tool...a feature is essential, as the knowledge of the T's, being 100."



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Airline Income & Expenses—August 1957

(Cha. Williams)

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Total Operating Revenue	Operating Expenses	Total Operating Income
							(Before Taxes)
ECONOMIC TRUCKS							
American	\$23,844,750	\$354,850	\$449,700	\$1,055,104	\$25,699,404	\$24,129,304	\$1,570,100
Braniff	6,449,876	326,560	40,754	136,793	6,953,983	6,432,100	521,883
Capital	5,344,441	181,246	49,481	107,547	5,782,715	5,458,447	324,268
Continental	5,161,476	44,816	15,761	30,321	5,352,374	5,037,863	314,511
Delta	5,911,377	336,160	39,593	130,760	6,417,890	6,146,186	271,704
Eastern	10,398,450	213,276	441,139	19,248,031	20,200,906	19,381,574	819,332
Northland	2,739,120	81,433	19,424	126,334	2,965,911	2,814,203	151,708
Northwest	6,164,449	134,347	374,400		6,673,247	6,239,126	434,121
Pan Am	10,423,747	339,444	134,481	12,719,672	12,902,644	12,501,404	4,011,240
South West	3,857,440	743,247	385,107	1,050,726	5,996,514	5,531,404	4,655,110
Western	23,905,847	63,440	31,000	11,003	24,001,344	23,334,126	6,667,218
INTERNATIONAL							
American	499,273	5,340	154	29,181	\$524,218	\$484,448	\$39,770
Braniff	469,800	18,210		2,801	490,811	472,540	18,271
Capital	164,614				164,614	156,124	8,490
Delta	244,710	6,768		13,490	264,968	260,740	4,228
Eastern	1,360,450	10,409	39,413		1,410,272	1,362,850	147,421
Northland							
Northwest	1,841,910	479,790	209,344		2,531,044	2,381,201	149,843
Pan American							
Alaska	214,000	11,709	71,300		297,009	274,800	22,209
Africa	12,614,000	347,000	152,000		13,113,000	12,920,000	1,193,000
Air to America	6,894,500	80,000	1,200,000		8,174,500	8,160,000	14,500
Europe	15,074,000		114,000		15,188,000	15,140,000	48,000
Japan	1,299,000	39,000			1,338,000	1,289,000	49,000
Latin America	6,792,104	611,117	467,100		7,870,321	7,646,510	2,223,811
Pacific	1,229,000	42,119		18,000	1,289,119	1,261,100	28,019
United	1,729,000	42,119		18,000	1,789,119	1,761,100	28,019
LOCAL SERVICE							
Albuquerque	\$911,271	\$7,000	\$7,150	\$1,093	\$926,514	\$914,979	\$11,535
Birmingham	108,417	2,801	1,210	5,487	117,915	114,516	3,399
Cincinnati	164,000	1,710	500	2,000	168,210	164,500	3,710
Cleveland	381,441	361,914	3,308	24,072	750,735	735,040	35,695
Columbus	154,361	1,074	8,600		164,035	161,140	2,895
Dallas-Fort Worth	791,434	763,248	14,142	12,760	1,581,584	1,568,311	13,273
Dayton	471,144	224,414			695,558	684,764	10,794
Philadelphia	688,182	1,854	4,710	9,686	699,392	694,341	5,051
Portland	95,743	8,699	4,710		109,152	107,847	1,305
San Francisco							
Seattle-Tacoma	296,000	6,734	3,314	13,214	319,304	316,400	2,904
Wash. Coast	744,741	9,348	1,814	4,142	759,045	750,644	8,401
REVENUES							
Miscellaneous	454,500	2,670	63,000		519,170	500,900	18,270
Non-Flight	300,000	1,074	13,000		314,074	300,000	14,074
CARGO (UNIT)							
American Sea-Amer		6,692	737,433		744,125	744,368	2,243
Flying Pig							
Western of Western							
Unit							
ADDITIONAL							
Chicago & Milwaukee	39,669	64,244		19,341	114,954	104,979	9,975
Los Angeles & Memphis	18,483	10,737	7,120	107,784	143,124	136,422	6,702
New York Airways	46,447	4,737	1,000	2,000	54,184	51,640	2,544
ALASKA							
Alaska Airlines	118,443	48,380	1,000	49,302	216,144	204,764	11,380
Alaska General	91,740	8,328		8,440	108,508	102,840	5,668
Overseas							
Alaska	99,473	5,338		4,818	110,429	101,710	8,719
Alaska	392,104	45,707	19,341	1,164,206	1,601,458	1,500,790	100,668

¹⁰ <http://www.irs.gov/efile>.

It is important to note that the use of

... (b) ...

Cancelled for Archelon Week from Dallas, Texas in the Gulf of Mexico. It was

[illegible]**BOEING 707**

More about Bristol's "Whispering Giant": world's largest, fastest, quietest, jet-prop airliner

INTER-CITY TRANS-POLAR



Inter-city or trans-polar... only the Britannia is a money-maker on such a vast variety of routes

Here is an airliner ideally suited to almost any stage-length... short or medium or long. Here is the only airliner that makes money in so many different ways... on inter-city, trans-continental, or even the longest trans-oceanic flights.

This is an airliner that outperforms all other passenger aircraft in service... the new Bristol Britannia... world's largest, fastest, quietest, jet-prop transport

Her record shows her to be the most versatile airliner ever to fly. She has no noise, runway or traffic-control problems. Her remarkable flexibility allows her to use existing traffic patterns and runways almost anywhere in the world.

Operators have already chosen Britannias for an amazing variety of stage-lengths, from short 300-mile inter-city routes to long 4,300-mile trans-polar flights.

Britannias will be flown between Mexico City—New York by Aeromexico; between Havana—New York by Cubana de Aviacion, and between New York—Washington and New York—Miami by Northeast. The same type of aircraft will be flown routinely across the Atlantic by BOAC and El Al, and on trans-polar and trans-Pacific routes by Canadian Pacific.

Powered by four 4120 h.p. Bristol Proteus turboprop-engines, the "Whispering Giant" cruises at 490 m.p.h., carries up to 133 passengers and runs operating expenses to a new low.

World-wide recognition and demand:

Britannias are in service on BOAC routes spanning four continents and have been ordered by Aeromexico, De Mexico, Canadian Pacific, Cubana de Aviacion, El Al, Israel Airlines, KLM, KLM-Canal Air Transport, Northeast Airlines, the Royal Air Force and the British Ministry of Supply.

BRISTOL
→
Britannia
Bristol Aircraft Limited • England

AERONAUTICAL ENGINEERING



CANADAIR has a licensing agreement with Bristol covering sale of this proposed turboprop which retains Britanni's fuselage.

CL-44, New Short Design Show Similarity

New York-Detroit proposal for a new turboprop twin-engine fighter without Bristol Britanni components was disclosed by Short Bros and the fact that at the same time in Greater London disclosed specifications for its CL-44 aircraft, which also is based on the Britanni.

Canadair, which is to build the Brit-

ann in Ontario, CL-44 for the Royal Canadian Air Force, has a licensing agreement with Bristol covering sale of the transport/cargo aircraft and its related parts. The CL-44 also retains partial parts. Canadair said it has extensive sales rights for the Canadair version.

The Short Bros. proposal, made to the

British Ministry of Supply, would use the Bristol Turboprop engine, in the CL-44 will. Unlike the CL-44, it would have a high wing but the wing design still would be the same as the Britanni. Other Britanni components retained would be the complete high deck, whole tail assembly and control system and the undercarriage.

Canadair Inferred

That Short Bros. had a transport project under study was known to Canadair, which has been informed by Bristol.

Canadair said that the Short Bros. project is a totally different aircraft and does not overlap the CL-44 in function.

Bristol also said there is no conflict between the aircraft. The CL-44 is a transport aircraft and freight carriage is purely accidental, Bristol said. It retains the Britanni fuselage. The Short Bros. project is reportedly designed for heavy freight movement, Bristol said, having a completely redesigned fuselage and used for medium range freight aircraft first and later for the transatlantic field.

Short's chief project designer, S. J. Robertson, worked at Belfast, Ireland, by American Waco, and fuselage will

be left to be again in the Britanni's. Designed in trial stage, the CL-44 is a standard fuselage and has a low, low level floor and a large nose ramp. A notable feature of the fuselage is the provision for separate pressure, temperature and humidity control for the flight deck and the freight hold.

Crane weight of the Short design must not exceed that of the Britanni but its payload must be 1,000 tons—about 10 tons. "It would accommodate 200 troops from a quick look at the specifications," said Robertson, "but no power elevator is shown freight."

Wing Changes

One wing was modified to be worked as a result of the higher landing weight. The main portions of the wing would slight thickening but this will not call for any jacking and loading changes. The Britanni undercarriage and power system completely unchanged, Robertson said, "we still expect it from the bottom corners of the fuselage and attach into fuselage bracing."

A thin wing is common wing. One engine with gross weight increased to 22,000 lb. A conventional aircraft would put the cruising speed up to 400 kt. and the payload to 50 tons over 1,000 mi.

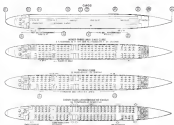
In discussing this new development philosophy, Robertson stated the Short "back future development of the Britanni will depend on a British wing and fully developed. One engine. But it is no expansion to go straight to it. The company hopes to do some quick business, open up a market with the Britanni wing version—opening costs would be very much down from Britanni costs—so that it can be allowed to introduce the thin wing version.

In an event," and Robertson, "the fighter version being slightly slower due to its high drag fuselage is better suited to the Britanni wing." Its optimum cruising speed would be down to 180-190 kt. Higher cruising speeds would mean the wing would get into critical Mach number area. Robertson inferred it was well known the Britanni was already suffering drag penalties due to its proximity to critical Mach number.

Thin Wing

Loss in the thin winged version the undercarriage geometry and most of the components will be retained. "All we need is slightly higher taxi, and then with for the hydraulic elements," Robertson said. The fuselage will be designed "from the wing on" to meet the final stretched thin wing gross weight specification loading.

Robertson declined first stage the company has been doing some "extra-



the integral wing configuration at Belfast its new thin wing will be a modified integral structure.

The One engine has been designed to plug into the Britanni wing. In its thin wing with Gross engine and a thin wing is a machine to be able to ferry 40,000 lb. of freight across the Atlantic at 400 kt. Robertson estimated.

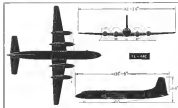
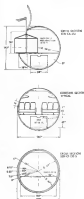
Canadair estimates that its transport will be able to carry approximately 70,000 lb. of cargo across the Atlantic at a cruise speed of about 450 mph and at a direct operating cost of 1.5 cents a mile. In the passenger version the aircraft could take a 150 passenger freight line from New York to London at a direct operating cost of approximately 1 cent a mile and, in sliding depression.

Environmental Control

Features of the Short freight specifications will be the provision for independent pressure, temperature and humidity control of the flight deck and freight hold.

Robertson cited maximum advantages of this system. The transportation of these materials is not by means and in present aircraft. They are virtually solid vehicles because of the need for long bleed air resources can be made when transporting steel products and with such items "arranging to use knowledge is very desirable too." Robertson said that conditions can be created for transporting fuel, oxygen tanks and most can be released "without freezing, drying or cooling the air."

Minimum pressure was stated as for the Britanni but the company has not overlooked the possibility of even higher bleed pressures for the transportation of items such as industrial gases and flammable gases at their bleeding. Night stops



CANADAIR is planning its CL-44 as a candidate for the low cost, long haul contract.

Bell helicopters have passed the most rugged test of all...



THE TEST OF TIME!

At work for more than
2,500,000 hours

- in the desert
- in the mountains
- in the Arctic and Antarctic
- in 32 countries of the world

...Bell helicopters have proved their dependability. And what better test of dependability can there be? Certainly no man-made test can simulate the operating experience of the Bell H-1B. No other helicopter has done what the Bell has done.

Because it's the actual "performance" — not "rehearsals" — that stands in the records, the Bell H-12 proudly points to its own...more flight hours, lower maintenance costs, more dependability... yesterday, today AND TOMORROW!



HELL H-134 FEATURES:

1. Largest approved overhead period
2. Interchangeable metal blades
3. Cyclic heat (pinus staining) that incorporates latest full design and developed look and load values.
4. Synchronized elements that provide greatest range of energy loading without burnout or catalyst shift.

BEARING ENGINE PROVIDES

- 1 Improved hot weather and altitude performance
- 2 Aluminium operating period reduced overheads
- 3 Reduced maintenance and greater reliability
- 4 Reserve power for emergencies
- 5 Aluminium availability — Aluminium cost



Watch "WHIRLYBIRDS" on TV...consult your local weather for time and station

as another problem with probable growth and "the company is looking for the word for an *Ambly* point unit doing a brown refrigeration plant with which to market its condition."

Future Action

Length of freight hold will be 50 ft. It will give 32 ft. square freightage. Short emphasized that a much smaller break-even order than with the reform will be possible due to high percentage of Britanna components used. Also, producing can begin quickly, the company said.

Canada is revealing final configuration data of the aircraft (cabin, troop port version) and that as its passenger configuration it will be known as the Canadian Lear as a cargo ship the Canadian Freighter. All versions, both the proposed civil and military, will be powered by the Oron engine which is rated at 5,128 shp.

The attempt will be "Americanized" as regards to materials, standards, work, costs, and systems.

Length of the transport will now be about 117 ft—up 25 ft longer than the CL 28, which up to the present is the longest place ever built in Canada. This makes available a total gross volume of 7,130 cu ft for cargo, or space for up to 114 passengers in the new—there's also seating arrangements with 34 in common.

Various other arrangements, reflecting different degrees of comfort from the least to the most limited or denied class, as well as combinations with room can be created.

Page 10/10

Its fast spread, of 10 016 imported golden snakes possible: a maximum range of 1 000 individuals with a substantial period and normal fecundity, providing growing transmissible and transpirable, as well as other diseases at all times of the year. Movement speed is 445 m/h.

To accommodate these policies, Canadian estimates the following weights:

- Maximum takeoff gross weight—703,000 lb.
- Maximum landing gross weight—160,000 lb.
- Maximum zero fuel weight—151,000 lb.
- Operating weight empty, cargo—66,121 lb.
- Operating weight empty, passenger—181,186 lb.

Canadair also is preparing its aircraft as a contender for the low-cost long-haul market. It compares the CL-60 projected 4.5¢ costs a two-mile cargo cost with a current figure of 10.5¢ cents a ton-mile, and the projected passenger seat-mile cost of 1¢ cent to current rates.

internal forest costs of \$5 each, including depreciation, of 1¢ each, ex. Oudine depreciation.

In the *Albion* and convertible versions the Canadian freighter has two large loading doors, maximum size 64 x 70 ft and a strong floor with tracks which are capable of supporting the heaviest cargo load. Special attention is being given to the problem of un-

The CL-44 program calls for delivery of the first aircraft to the RCNVT late in 1999. Commercial versions could be delivered from the beginning of 1999.

Turboprop Cessna 340

Ready for CAA Testing

Cryl Avionics: Administration certification flight tests of Cessna 750 powered by Napier Elrod engines will start in mid November at Pac Aero Engineering Corp., Santa Monica. Under amended regulations, conversion will be a modification, not a new design.

Following certification of the company, Pac Aero will convert three 140-seater to Next American National to Elard tailswap requests. Pac Aero also will convert a Nager 440 to Elard and obtain certification under the contract, which total approximately \$1 million.

The New York American

Hewlett-Packard Company



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A PERSON CAN BECOME CAPTAIN

In every country you find men like this man whose natural home is the sky. Captain Edwards has been a pilot for 22 years, totaling nearly 11,000 hours of flight. His preference and extreme interest in flight engineering, is shared in by the amateur droneeers interested in him by French and other countries. His record is typical of the men who save the ghosts of Las Vegas, the nation that has been saving the people of 73 countries.

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1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

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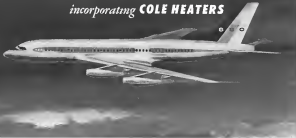


Illustration courtesy of Convair Division, General Dynamics Corporation



15 K.W. Duct Heater, engineered and built by Cole Electric Co. for Hamilton Standard's air-conditioning system in the new Convair 880.

It's mighty cold at 40,000 feet, yet passengers in Convair's great new 880 jet airliner will relax in complete comfort, thanks to a highly-efficient air-conditioning system by Hamilton Standard Division of United Aircraft Corporation.

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Soviet Progress Spurs Machining Study

By Irving Stone

Los Angeles—Accuracy of production methods recently that Lockheed Aircraft Corp. is conducting to achieve ultra-precision for cutting complex aircraft materials is underscored by progress the Russians have made in this field.

Discussing production aspects of advanced aircraft structures, Lockheed engineer Alfred H. Petersen told the fluid control Conference Machinery Committee here that the Russians have apparently far outstepped the U.S. in releasing theories of critical machining variables to produce thousands of parts and tools—far beyond those used in this country in normal practice—have been reported through qualified sources, he claimed.

One indication is that the chips they have been producing are pure plastic (tying spontaneous) and do appear into dust or, with the work

piece assuming the roles of a carbide and with tool itself remaining cool.

The transition to stronger and tougher alloys than are being used today is going to be slow, Petersen stated, as are concerned and for the next few years, at least, will not be complete, Petersen declared. But in the field of machining, where great strides have already been made in shaping and automatic control during the past few years, a still greater effort must be expended in research and development and into tools and more efficient machines, tools and techniques, he stressed.

Theory of Velocities

In his discussion of cutting speed, Petersen referred to the critical machining velocities developed by Dr. E. S. Salmann, German researcher. Salmann's work, he said, has been further substantiated in part by a theory of Dr. Theodore von Karman which, in effect,

holds that a force which would create fracture at 200 speed, if applied fast enough, will cause delamination of the materials instead of fracture. Petersen explained.

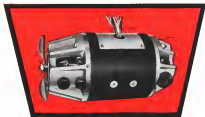
In discussing Salmann's and von Karman's theories with Lockheed scientists and research personnel, good agreement was found that these theories are sound, although some modifications may be necessary, Petersen said. As a result, Lockheed has initiated a series of tests intended to get some rough idea as to what happens in the workplace and tools at very high velocities. First problem was to achieve desired velocities and for this, Lockheed adopted a rifle firing technique. Rifle used was a Mauser with a special smooth barrel band to accept a 100-m-dia slug. On the end of the barrel, a tool holder was mounted. Cartridge cases were loaded with various grades and quantities of powder. Slugs, designed to fit the case, were 2 in. long made of AISI



H-34 Carries Varied Armament

Army H-34 Chinook helicopter loaded at Shideby Aircraft plant at Bridgeport, Conn., carries a wide range of armament. Included are two .50 cal. machine guns, one on each side of the cockpit door; 10 rubber machine guns, one on the right of the cockpit and two on the left; or 30 rubber machine guns (electrically fired) and rocket tubes; both 2.75 in. rockets, 20 in a rack; and two 4 in. rocket tubes; rocket tubes. Fittings were designed, made and installed by Shideby.

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All the regressing inputs, built into a linear model was discarded by a reliability problem in the gradient over steps.

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4348 steel heat treated to 250,000 psi ultimate tensile strength.

First frags were made across single point tools ground to 90 deg. methods angle and in various alloys and carbides. Initial frags were chromograph and x-rayed, doctored as required, 1,280 typ-1172,808 after—were recorded. Second series were run with a fish-tail tool, and surface foot per minute was increased to 34,000.

Carries Observed

In both series of tests, definite crushing action was observed without tool failure, except for a carbide tip in the first test. Cores were smooth, rounded groups of slugs measuring 20 inches wide. In case in location of 3 to 4 points Backwell C was restricted in the slugs to a maximum depth of 110 in below the scratch surface, but otherwise no effects on structure or strength were noticeable.

"To date, we have not been able to observe the northeast chop surface, wave, diurnal, tides or pleased which will be fully understood to that all variables can be studied," Peterson declared. Chop produced in tests was, he

From these tests Lockheed expects to establish critical velocities for cutting all aircraft materials.

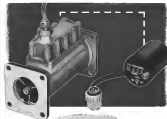
Conceding on his critical view of them can be reduced to poster, Petrus and Brouche, this is a new Linear rule. The mental effort may be to establish the validity of the theorem and then the machine tool builds your design back with the necessary elements and rigging to reach the target. When it is noticed that the power requirements fall off in an exponential proportion to the speed of cutting, then the idea becomes more rational. It is better that present work in computer devices and the concept of structural vibration may contribute something worthwhile. They, for linear and peripheral machining, while stress and cutter size are not limited, it's a job of displacement."

Productivity Barrier

Peterson emphasized that perfect and constant walking of hard efforts at these speeds was not to be favored. Spas, bursts and rickshaws downed of small pockets and small flicks throughout the piece will constitute a various productivity bonus, he pointed out.

"One must have the utmost respect for the structural designer and his wonderful ability for getting the best use of weight out of a structure and for showing loads through the frame across sometimes tortuous paths. But metal-buyer, production engineer and tool designer must work much more closely together than has been the custom."

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ing with external stresses of shock and alloy with which he is to function for many years to come, simply because high-strength alloys will degrade themselves, what's more important, because our whole defense economy is based on our knowledge of how to design and fabricate aluminum structures. The temperature-resistant alloy used needs improvement not only from a strength viewpoint and ductility standpoint, but they must be capable of being processed so as to afford the maximum likelihood of The production and tooling expenses have the great responsibility of keeping the design and the methods of producing it advancing in equal stride.

ADC Fighter Pilots Will Train for SAC

An Air Force need for some pilots with anti-aircraft training will result in reassignment of 100 Air Defense Command fighter pilots to B-7 training centers for subsequent assignment to Strategic Air Command bases.

Training was much because changes in USAF requirements have required assignments for fighter pilots while leading of the jet bomber crews has increased the need for pilots with anti-aircraft training. Lineup of an fighter pilot age was another factor—one that indicates a requirement for a pilot retrain program.

Cutbacks to Result In Drop at Lockheed

Employment will be cut at Lockheed Aircraft Corp's California Division from about 25,000 to about 24,000 workers by the end of 1957 as a result of military personnel cutbacks.

Burt C. Monahan, vice president and general manager of the California Division, said that company-wide, Lockheed's position is bolstered by a sharply rising level of business and employment at the Missile Systems Division and prospects of continued business at the Chicago Division and Lockheed Aircraft Service that will bring only slight declines in employment.

Lockheed's total backlog of firm orders and sublet business presently approaches \$1,142,000,000, with contract additional contracts making completion.

New sales of sublet orders could improve the employment outlook, within the California Division next year. Monahan said, "but perspective new military orders would have little effect until 1958 because of long tooling and processing time necessary on all new orders."

Numerous developments could alter the forecasts made now. But based

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which an aircraft business and not allowing for the probability that further commercial sales efforts in other markets might also be required, one has only to study a possible record of 1973 work logs of around 17,000 at that time. Finally, the Maywood plant's consideration about the use of the actual Lockheed engineering at the start of the Korean buildup, Northwood said.

Army's Aviation Funds Ample for Essentials

Defense-Aviation studies, despite recent Defense Department cutbacks has enough money for its essential programs, according to Donald Thompson, technical director of Army Aviation Research and Development in the Office of Chief of Transportation.

These essential programs—building the H-40 program—will be handled completely. Thompson held a meeting of the Southwest Region of the Army's Helicopter Society.

Thompson flew the H-40 in Bell's Ft. Worth plant and he had high praise for the new turbine jet and helicopter. He told his audience, "I've never seen a lot of Bell's equipment. We're developing the H-40 program at all costs and we would have to be completely back to back it."

Engineers working on design for the Army will be able to draw on Army experience when a new Army Aircraft Design's Guide is published, Thompson said. Work on the guide is under way at Ft. Belvoir. It is expected to be ready and signed.

The guide will put in past what the Army has learned in operating its various aircraft. It will include lessons that experience shows. Army aircraft must have, and it also will describe field tests and engineering changes made to correct the Army's new design.

Thompson explained the Army's procurement philosophy, in general, is a question of whether Army has had the look and feeling in its specifications or buying them all the while. He said the general feeling is that better results are obtained from going specifications and buying, to the taxpayer to build on surplus. The method goes for the Army, the aircraft it wants and Thompson and the H-40 is a good example of this approach.

Engines for Atlas ICBM Enter Production Phase

Nozuko, Mo., plant of North American Aviation, Inc. a Rocketdyne Division is beginning production of engines for the Atlas intercontinental ballistic missile. Nozuko plant has been in build up production of the developing missile engine since February.

AVIATION WEEK, November 11, 1973

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The new T-150 tractor travels up to 32 mph, turns in a radius of 12 ft. and is only 4½ feet high so it can easily maneuver around planes. Optional equipment includes 24 v. electric system, diesel or LPG power, 2 main sets, 2-way radio units and easily attached scrapers, snow plow and winch attachments. Any Hough Distributor has more information on the Model T-150 or smaller "PAYMOVER" tractors. Contact him or write, The Frank G. Hough Co., 178 Berryville Ave., Libertyville, Ill.



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Thompson pointed out that, when the Germans were developing the V-2, they went ahead and built 6,000 of them in a two-year period while development was still under way. Germans fired about 3,000 V-2s before the missile was fully developed.

Conover officials said all this is the price of the muscle's lack of capability for repetitive testing. It forces the in-

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First photo of the actual French MATRA R.540 air-to-air missile shows the weapon mounted for test purposes on a French air force jet test-bed. MATRA can be fired at altitudes between 10,000-45,000 ft. Speed is Mach 2. Missile is now in the pre-production stage. Total estimated weight is 170 kg.

AVIA/204 WILEY November 21, 2007



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J-M insulation specialists will be happy to demonstrate for you the design advantages of integrally insulated shrouds. Just write Johns-Manville, Box 14, New York 20, N. Y. In Canada, 266 Lake Shore Road, East, Port Credit, Ontario.



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Lightning Strikes Depth Charge Spray

Depth charges with phase rate 100 ft. induced burst test in discharging from lightning bolts on perfectly smooth top. Scientists of Naval Ordnance Laboratory, Silver Spring, Md., were conducting experiments on Chesapeake Bay. Discharges all followed same downward induced path, struck unerringly. Depth charge was experimental and there was no indication of electrical activity in air.

agies to evolve a development philosophy aimed at reducing basic and cost and increasing reliability.

Deputies, Civil-Naval Corps, Bureau in research development.

A laboratory and techniques learned in aircraft development are neither followed nor discarded without analysis.

Facilities, past a program, and they engineer staff and selected high level scientists. Deputies and Civil-Naval had recommended that problem.

Test planning, requires early attention and detailed planning.

Change control is important to balance engineering's demands for non-ferrous changes and production's cost-cutting to any change.

Prager vanguard selection is important to reduce variability in the program process.

Management must expect and accept failure, which is not planning and a necessary in such a program.

Gen. Boyd Retires

Baltimore, Md.—Maj Gen Albert C. Boyd, deputy commander for weapons systems of the Air Research and Development Command and veteran Air Force test pilot, retired last week after 16 years of service.

Gen. Boyd was the first commander of the Air Force Flight Test Center, Edwards AFB, Calif., and later served as commander of the Wright Air Development Center before reporting to AEDC headquarters in 1975.

In 1947, he established a world speed record of 521.5 mph in an F-86B, achieving the record in the U.S. for the first time in 34 years. He was the co-pilot of the Odette-Chateau event of the Institute of Aeronautical Sciences in 1955 and the Air Force America's Air Force Trophy in 1948. He also has been chosen a fellow of AAS.



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Friendly Foe

When a new air defense missile is produced, its "kill accuracy" is theoretical until it is tested against a realistic target under operational conditions. The new, sophisticated missile target, USAF XQ-4, is one of many "friendly foes" developed by Radioplane to simulate various air enemy threats.

Duplicating the performance and radar appearance of a supersonic, high-altitude bomber, the radio-controlled XQ-4 is designed to test the seek-and-kill ability of air defense systems and their missiles.

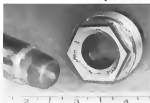
As major advancements have been made in U.S. Armed Forces air defense weapon systems, Radioplane has designed and developed targets compatible with the missions of these weapons. The XQ-4, for example, not only inflates unloading bombs, but inflates up the score of hits and misses when fired upon.

Radioplane, the first to produce remotely controlled target aircraft, maintains dynamic research programs to seek new solutions for tomorrow's defense problems.

Radioplane
A Division of Northrop Aircraft, Inc.
VAN NUYS, CALIFORNIA, AND EL PASO, TEXAS



EQUIPMENT



STEADY valve seat at plunger held closed after 28 hr. opening time. Temperature varied between 775-1100°, pressure between 1,360-1,600 psi. Silica contaminants found (right) as a result of testing with Osmose 5515 fluid at 700-800°.



Hydraulic Designers Fight Heat Effects

By Ronald Hawley

Conventional hydraulic fluids and component materials can't fulfill the demands of new hydraulic systems in withstand high hydraulic system temperatures caused by continuous heating.

Use of hydraulic boosted flight controls calls for high response rates and meet such new problems as resonance and coupling between hydraulic system pressure and surface deformation.

Special requirements of metals also contribute to the rapid change of hydraulic technology, and on the location of such problems in gaskets and sealers indicates critical.

Changes in Choice

Regard changes in hardware due to high temperatures are set to come. Hydraulic system engineers at Pacific Division of Borealis Aviation Corp. estimate that 50% of current production is extended for temperatures to 180°, 25% for temperatures to 190° and 5% for temperatures to 1,000°. The properties of high temperature units is probably greater than the industry average since fluids provide the backbone of the Corvair 8-35, first large supersonic plane. They predict that in the next two years the proportions will change to 50% for 180° applications, 45% to 190° and 10% to 1,000°, then remain constant for about five years.

Kevlar is the complex of problems being the danger of a high temperature hydraulic system is the problem of fading, or degrading fluid. Adverse effects of elevated temperatures

on conventional hydraulic fluids include breakdown to:

- Excessive swelling and compressible, absorbing part of the energy they are expected to transmit.
- Cook out carbon-like deposits that tend to clog filters and stop valves and ports.
- Develop shock-like-moving vapor pockets and lowering flash point and viscosity.
- Become increasingly corrosive on one result in the metal.
- Lose their solubility.
- Erode pipes.

Silicate Ester Fluids

Petroleum base fluids are useful only to about 77°F. Silicone ester based fluids are being developed for use to 450° and liquid state metals have been discussed for use at temperatures as high as 1,000°.

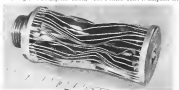
At Wright Air Development Center,

the most promising of the liquid metals is considered to be eutectic alloy of sodium and potassium, NaK 77, with a boiling point of 1,413°F and a melting point of 10°.

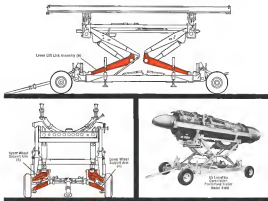
First Application

First of the silicone ester fluids to find application is Osmose 5515 which is used in the B-53 Osmose 5200, an other silicone ester, will replace 5515 when packing materials are found which will work with it at -65°F. It has better viscosity and stability characteristics than 5515.

The B-53 is typical of the upcoming airplanes which will pose the heating problem in hydraulics. Its 330 hp is, double engine operates at 500° and one component has a 10 hp motor in which a temperature of 500° is reached locally. B-53 must be capable of standing at -64°. Since Borealis has found that a failure which is acceptable for



WEEK work like cylinder after being clogged with sludge that was formed from high temperature testing. This is one difficulty that faces hydraulic system designers.



Kaiser Aluminum forgings are shown as set into the Pioneer lift arms.

ALUMINUM FORGINGS SAVE UP TO 50% IN COSTS — 50% IN WEIGHT

As determined by Air Logistics Corporation cost analysis, the forged aluminum wheel support arms shown above retained a 58% cost saving, as compared to steel weldments. The lower lift arms retained a 60% cost saving.

These same aluminum forgings also made possible the following savings in weight as compared to steel. Wheel support arms—50% weight saving; lower lift arms—40% weight saving. Yet the trailer shown is strong enough to handle loads up to 8000 pounds.

And, as additional advantages, the aluminum forgings

provided superior springing action and added pleasing appearance to the trailer.

Next time you're faced with a design problem involving costly and complex parts machining and assembly, consider the inherent advantages of single aluminum forgings.

For complete information contact the Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palmolive Building, Chicago 11, Illinois, Executive Office, Kaiser Bldg., Oakland 12, California.

THE BRIGHT STAR OF METALS

KAISER



continuous operation at 1200 will be acceptable at 900 for a short time, it is designed to the most continuous operation of 900 continuous operation.

8-58 Hydraulic System

The system operates at the usual pressure of 1,000 psi. It is a dual system powered by two capacity-driven pumps moving about 18 gal per minute at 1000. Highest ambient temperature are estimated at 1200. A cooler is incorporated in the circuit to prevent temperatures exceeding 1500 and a thermostat control holds temperature above 1000. Shutoff valves can range reduce temperature at desired variation in hydraulic flow.

Largest proportion of system built has been found to be produced at the pump. Most of the remainder is due to hydraulic conversion of the flight controls.

Use of a viscous ester base fluid like S115 has helped reduce problems. Atmospheric air is sealed out by a seal (seal) and (seal) fluid is driven into system from storage containers by pressure (seal).

• Nitrogen atmosphere is maintained in ground test cell and test bench (seal).

• All other fluids are removed to be contained. It was found that in the presence of oxygen, a small amount of 1000 to S115 causes both gelling.

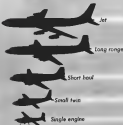
Fluid Life

Nitrogen pressure change is used in all accumulators since the fluid does an accumulator put aluminum in a low several test runs, during the longed operation at high temperatures. Fluid replacement in accumulator system is required to be controlled directly by retention of properties rather than on length of service. Engineers at Boeing Pacific Division would prefer to do it the way Boeing sales engineers in service conditions and high price of fluids make it difficult to set an action. Service life without accepting a costly loss in fluid retention. Results in designing a fluid life for determining fluid properties. Only viscous fluid, down and continuous action critical test conditions are shown in another possible reason. After some time a loss of air in one test, fluid point of 800 is lost in 1200 because of alcohol burnout through viscosity increased within hours.

The system has been designed to pump gases to the system (seal) call for single point bleed-off. Initial filling and meter maintenance are done without breaking into the system. Calibration plate is the only conventional material specifically evaluated from the system because of fluid in

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say for stays in the paper." That's why Albanene is the best seller among all tracing papers.

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Or use a plain sheet of paper if someone's already snatched the blank below. Give your name, address, and firm name, twenty-five words or less telling why you prefer Albanene tracing paper, and mail to K&E Albanene Contest, Box 160, New York 46, N. Y. before midnight, November 30, 1957.



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Here's why I prefer Albanene Tracing Paper:

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Street: _____ Firm Name: _____

1. Will it 25 words or less? Why I prefer Albanene tracing paper?
2. List all entries in K&E Albanene Contest, Box 160, New York 46, N. Y. 20010 as often as you wish. There is nothing to lose.
3. Entries must be postmarked not later than midnight, Nov. 30.
4. Entries become the property of K&E and they may use them as they see fit.
5. The decision of the judges is final.
6. Winners will be notified by mail. A complete list of winners will be sent after the prize drawing. Payment is guaranteed by K&E, no official receipt needed.
7. Drawing is open to all residents of the United States and all possessions, and their immediate families, or having a close tie with the corporation and industry. No restrictions on age and subject matter.
8. No entry and multiple entries of those whose names they are prohibited from.

compatibility. At the elevated temperatures in this system, even 50:50 fluid, would they condense. Most streamlines effects are acceptable but some selectivity is required. Conventional electrical systems are stopped by 50:50 but copper and silver are preferred.

Silicate crisis refers to the constant vacuum, fairly good thermal stability and low volatility over a wide range of temperatures but are hydrolytically unstable in the presence of water. Also at temperatures around 1400°-1600° below the boiling point of present organic base fluids to the 2000°-2100° range first of the experimental high temperature fluids, MLD 8300, was a blend of base (2-ethyl hexyl) diisobutyl and polymeric silicone to improve viscosity index.

Addition of 15% diester to ester in a swelling agent gave adequate physical properties, including good release rate.

Sealing Technology

Most of the technology of sealing, which is a fundamental problem in hydrostatics, deals with resilient compounds. Acrylic and nitrile are leading the temperature range where they are preferred. It is hoped that materials now appearing on the scene will push the limit of pistons to 100°.

As in other branches of aircraft design, hydrostatic engineers are running out of the state of base knowledge about behavior of nitrile and other materials at high temperatures. Accepted metal aging in stabilizing processes are no longer adequate. Tighter limits on

tolerances are among another set of manufacturing problems. Techniques for building polymers in two-thirds months or less, or in such are based upon the use of very hard materials which are had from the standpoint of control stress. This method between manufacturing and application may not allow the small component design.

There are indications that one of the worst bugaboos will be noise. Metal is more susceptible at elevated temperatures and fluids are more active chemically. Cavitation also becomes more likely. How serious a threat this will be is not yet known. Theoretically, the amount of energy released at a point by the implosion of small bubbles of vapor approaches infinity because it is all directed at a single dimensionless point. If this point were close to a surface the implosion might even carry more massive quantities of metal. This is the principle upon which ultrasonic vibration cleaners work. Cavitation can also be caused by the mixing or colliding of a high velocity stream.

Design Headaches

Combustion in size and weight is a controlled volume, volume against a number of obstructions to ease the designer's problem. Large diameter holes and high volume actuators, valves and pistons would lower fluid velocity and cause a loss of life, but there is no room for larger pistons and this might possibly for a larger volume of fluid is unacceptable. Small, high velocity loss is not in turbulence and the consequences of



Sputnik Rocket Leaves Trail

Third stage of rocket which launched Russian Sputnik into orbit leaves a white trail in time exposure photograph made by an automatic chronograph. It is aluminum dusted gradual spreading of white dust, indicating its life in outer orbit.

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much poorer into heat. Ultimately, Reynolds number determines fire rate. A tendency to go to higher pressures compounds this, possibly produces the threat of bad local heating and erosion where there is mechanical contact and friction. There is little that can be done to prevent heating of this sort. Heating due to fluid friction may put local temperature over the red line when average temperatures approach design limits.

It has been suggested that corrosion be replaced by scales to reduce the acceleration of heating, but corrosion is serious and affects in value. Much corrosion takes place at the pump and it has been suggested that if electroosmotic pumping can be made practical this will be much reduced or even eliminated.

Some alkali metals appear to have acceptable properties for applications up to 1,500° according to a recent Wright Air Development Center technical report by Richard H. Bickner. He has concluded from the results of Atomic Energy Commission test program that mixtures of sodium and potassium (NAK 77) is the most serious long high temperature liquid metal known.

Unfortunately, its melting point is 100° far above maximum acceptable temperatures now specified. This difficulty might be sidestepped by operating the sodium heat-exchangers on the ground and pumping the fluid through heater elements in the reactor. A fluid carrying material which will deposit scaling point.

Corrosion and oxidation have been suggested as possibilities. A few estimates show that lower melting points than NAK 77. Melting points listed by WADC are:

- Potassium (775°) and sodium (NAK 77) (775°) is 148°
- Cesium (2851°) and potassium (775°) is -51°
- Cesium (133°) and rubidium (373°) is -68°
- Cesium (187°) and sodium (893°) is -70°

NAK 77 Attributes

While the properties of cesium, sodium, potassium and fluid properties of the other metals are less favorable than those of NAK 77. But a better insight into the use of these metals for producing NAK 77 is given by a review of costs (based on 1951 data):

- Rubidium—\$2,180/lb.
- Cesium—\$1,380/lb.
- Potassium—\$2,160/lb.
- Sodium—\$ 16/lb.
- NAK 77—\$7.05/lb.

In addition to an important factor independent of its effect on cost. It is hazardous that on a few such of cesium and rubidium were produced in



1951 compared to several thousand tons of NAK 77. NAK 77 looks much like mercury, but in an inert atmosphere is more stable.

It is very light, reactive with oxygen. When poured, from one container to another its other color cannot be seen, as rapid as the formation of black scale sludge on its surface. It will spontaneously ignite in air at 255° or at room temperature if oxidized.

Other NAK 77 Characteristics

Room temperature ignition without detonation has been reported as the presence of heavy moisture.

NAK reacts violently with water at lower hydrogen and producing enough heat to ignite both hydrogen and air as a gas. Water applied to NAK always produces a violent hydrogen explosion.

NAK that is heavy in water vapors, heavy hydrogen is it is formed and

usually explodes scattering burning NAK.

Surface tension of NAK 77 is about twice that of water and considerably that of mercury. Rate of surface tension to density is about the same times that of mercury. Specific gravity of NAK is good for a hydraulic fluid. It is heavier than water and not much more so than NAK H-6604. In density fluid, viscosity is lower than desirable. At 111° it is about 0.565 compared to the same at water.

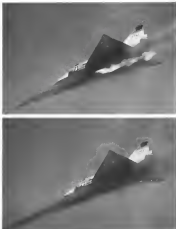
No data on bulk modulus are available but, inevitably, measurements are derived from data on sodium up to 300° with extrapolation to 1,000°. These data show sodium to be about three times as stiff as NAK H-6604.

Handling Problems

Handling problems with NAK 77 appear difficult but solvable. A liquid double column must be hermetically sealed and must contain an inert cover gas because of the ease with which NAK reacts. When NAK burns,

F-102A Fires 24 2.75 In. Rockets In Rapid Sequence

General Electric F-102A fires 24 2.75 in. rockets in less than half a second. Rockets leave tubes in the middle two doors of the ejector two at a time, and the first pair are caught by high speed camera (top left). Two tracks of a second later (top right) the full column blast of the 24 rockets has blossomed. Rapid motion camera catches the three rocket tubes in each of the F-102A four missile doors (bottom left) before they close. Rocket's trail of particles gray central spots continue from rocket blast, and blast is at least only a thin line of dust remains in evidence of long. High speed camera exposed 20 frames per second to catch the rockets streaming out in flight (right).



combustion is rapid and non-explosive if in water in present, but forms are dangerous to handle, being dense and caustic.

Quick contamination increases considerably. With oxygen concentration greater than 8.00%, attack of traces allows a scummed. A concentration of 0.1% of sodium scale will combine the surface layer of stainless steel, causing it to crack when deformed. Oxides are precipitated out of the fluid by a local temperature drop and are clog the system. It is possible to capitalize on this failing by incorporating a cold trap for oxides. A temperature drop at 200° between the hot and the cold trap appendage would just about preclude the possibility of oxides solidifying elsewhere in the system.

- Selection of materials for use in a high temperature NAK hydraulic system must be based mainly on:
- Resistance to corrosion
- Mechanical properties at high temperatures
- Boiling properties

- Resistance to diffusion bonding (self-welding)
- Many materials are compatible up to 1,000° but such a low ratio is considered, because and lead much when acceptable burning combinations. This is a very important consideration since the hazards of NAK is negligible. Even the

best bearings have friction coefficients 30 times as high as NAK as in light of As yet, there is little information available on lubricants, additives or dry film lubricants.

Properties of some materials to self-weld in applications like valves and seals is enhanced by the presence of NAK.

D. W. Douglas, Jr., Succeeds Father

Statis Menlo, Calif.—Donald W. Douglas, Jr., 40, was named president of Douglas Aircraft Co last week, succeeding his father.

The senior Douglas, who founded the company 37 years ago, remains as chairman of board.

Frederic W. Coates, senior vice president was appointed vice chairman of the board and will represent the chairman in the latter's absence. John Douglas, vice president of aircraft division, was named executive vice president and a director of the aircraft company.

Civilian C. E. Feltz, USAF (ret) was elected vice president in charge of the company's custom offices. He joined the company Oct. 15.

Douglas testing division has joined the engineering department under the leadership of Arthur E. Remond, vice president of engineering. All roles activities including military as well as commercial will now come under the cognizance of Nat. Preschler, vice president of sales.

Donald Douglas, Jr., was formerly vice president in charge of military activities.



BURROUGHS RACAR DATA PROCESSING EQUIPMENT INSURES OUR CONTINENTAL AIR DEFENSE

Warning systems for defense in development today are geared to the instantaneous speed of electronic computation.

As a part of this job, Burroughs radar and other real data processing equipment is fulfilling vital roles in existing military defense systems (like reliable example: SAGE). It is assisting key air personnel in projected air traffic control systems as well.

Here is one more demonstration of Burroughs capability and reliability in all facets of defense projects from research to field service. Areas of our present competence include electronic computers and data processing instrumentation control systems and communications.

We invite further inquiries. Write, call or visit Burroughs Corporation, Defense Contract Organization, Detroit 32, Michigan. Or Burroughs Defense District Offices: Rock, Pa. • Dayton, Ohio 45408 • Under Ave. • Texas, Calif., 17071 • Ventura Blvd. • Washington, D.C. 1145 19th St. N.W.



THE FOREMOST NAME IN COMPUTATION

AVIONICS

Ticketing Handset 'Reads' Pencil Marks

By Philip J. Kline

Transactor, a new device which should speed the processing of airline reservations and provide valuable operational data for flight scheduling, has been developed here by Trans-Canada Air Lines and Transair Electric Ltd.

TCA has also developed new airline data processing techniques which it says can cut cost of equipment, installation, set-up and operation handlings.

Costs of *Transactor* and new techniques is expected to reduce by 50% the \$1 million separate transactions now required to board some 150,000 TCA passengers every month. TCA is expected to report bids from industry for its proposed system in the near future. Further, which developed the prototype *Transactor*, will also do the computer portion of the system.

Versatile Transactor

Transactor uses a light read-aloud to the agent handles now used by many airlines for intercepting automatic reservations computer feed data in one very important respect. When conventional agent handsets require the ticket agent to select and insert a metal plate and then punch appropriate data the *Transactor* uses automatic, and instantly "reads" pencil notations made by the agent on a small card, then transmits the computer for the required space.

This means that the *Transactor* can, without modification, handle a number of different types of cards to provide data from space-availability information. For example, the machine can intercept the message for the total number of passengers on any scheduled flight (passenger block), on the location and estimated time of arrival of any in transit airplane, or about any other information of interest that can be stored in the computer.

Flight Plan Use

This flexibility, suggests that the *Transactor* could also be used to enter aircraft flight plans in a traffic control computer and to an input-output device for some other air-traffic applications.

When a ticket agent receives a request for space the plane is on period, he takes down the required information on an IBM card, and using an automatic will read pencil notations on such



TRANSACTION, new airline agent handset for intercepting automatic reservations computer (above) automatically "reads" pencil notations down by ticket agent on reservations and (below) punched marks along right edge (new space was sold, subsequently cancelled, for one seat on Feb. 11) on July 29, Winnipeg to Montreal.



things as originating station, destination, time, flight number, date, number of such requests, etc., is recorded on the card by drawing a pencil line between pairs of tiny circles on either side of the desired number or code (see card above).

Transactor name, address and telephone numbers are printed out on conventional tickets, but could be recorded by pencil lines if TCA decided to store such information automatically.

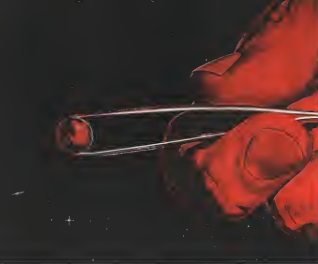
When the card is filled out, the agent inserts it in the *Transactor's* slot. The card is automatically gripped to permit its withdrawal for two or three seconds until the operation is completed. To take the device 300 per of time shown

ticket breaks made electronic contact with up to 300 pairs of tiny circles. If a pencil mark has been drawn between any pair of tiny circles, during the closing path of the pencil line. Otherwise there is no current flow.

In less than one second the *Transactor* has electronically scanned (read) the message and the information or information is an in way to the central automation computer.

Reply Focused

When the computer has scanned its reservations inventory, its reply is automatically punched out along the right-hand edge of the card, indicating that space is available and has been sold to the requester. (The flight is sold out,



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Stewart-Warner Electronics has pioneered in the development of solid state circuitry. Out of a manufacturing environment second to none, Stewart-Warner Electronics is mass producing equipment containing solid state devices by the thousands of units.

Your problem of solid state circuit design and production techniques will be handled at Stewart-Warner Electronics with equal efficiency. If you are an engineer interested in advanced circuit development, write: Stewart-Warner Electronics, Dept. 14, 1309 North Kostner Avenue, Chicago 51, Illinois.



One of 140 plug-in modules for the dedicated Strategic Warfare Data Processing Unit. Modules employ solid state circuitry on new space and miniature many vacuum tubes.

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a Division of Stewart-Warner Corporation



TRANSDUCTOR, with dual transistor

Just slow down tape storage in its shortest in the main computer memory (TCA) analysis, for example, recording fuel.

• Fifty per cent of its interventions act on, limiting its recording speed takes place within five days of flight departure; 75% within 10 days.

• One-handed transistors are made for every 100 original bakings, but more than half of these take place within 48 hr. of flight time.

Richardson likewise believes that the main computer system some sensor could be used to store full inventory data on flights only for data in advance. Invention for an flight was done for days off will be stored in the rapid access computer memory only if the flight is approaching and off. Otherwise the inventory is stored in the memory tape memory. The latter will be accessed at regular intervals and the inventory of flights approaching will be transferred to the main computer system—operation of when the flight will depart.

Speedy Service

When a Transducer reports apart for any flight, the computer searches its rapid-access memory. If the flight is more than five days off and is not "killed" in the memory, the computer signals the Transducer to fill the space and records the data on magnetic tape. If the flight is killed, the computer erases the memory content to detect when whether it can fill space. In other words the latter speed gets in its immediate reply.

The system which Richardson explained to Aviation Week will be designed to provide a variety of open-ended data which historians have been unable to afford and only to assemble. For example, it will be possible to obtain periodic sensor reports which show how many transistors have not made by each station (and each Transducer, if desired) per day, per hour or for any other desired time interval to determine what agent prevented work.

Sensors can be set up to conduct special surveys on any subject. For example, if TCA wants to know what

Mission Accomplished...



with an FM Telemetry Transmitter

There's not much left of a minute or so in components after it starts back into the earth with a force of many thousands g's. Since it's virtually impossible to know what happens during a test flight, weight data must be remotely collected by telemetry.

The Radiation, Inc. Telemetry Transmitter is designed to ride these attitudes and transmit information back to the ground station during the flight. It is built to operate reliably in the extreme environments (100g shock, 2000 g's vibration, -75 to +75°C) encountered by the missile. Its small size, light weight and rugged construction make this transmitter the best available for such applications.



Spurious Rejection	—	60db below carrier
Frequency Stability	—	±0.1%
Frequency Range	—	215-235 mc
Power Output	—	2 watts
Weight	—	1.7 pounds

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Inquiries
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RADIATION INC.
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A Vought Vignette

NO. 31 IN A SERIES

The flight safety engineer who went for a spin

Inside the whirling cockpit, Chuck Miller was confused. He had snuffed a spin recovery kit but landed for the spin phase. He barely and moved. Now his control hands could be held into the control stick.

Seconds later the spinning stopped. Flight Safety Engineer Miller climbed out of the University of Southern California's convoluted, computerized notes with a Vought test pilot. Next day they were winging back at Vought. With them was a taped and dated record of their confusion test. It documented a possible flight hazard and urged measures to prevent it. It also showed the responsibilities of Vought's Flight Safety Engineers.

They had been cleared some weeks before by a memo (written from Amesbury) to ensure that Miller take of Vought's Crusader flight in the Langley Spin Tunnel. But this showed the flight safety engineer on a typical day. This would impose a high pressure. Over the first G load on the pilot.

Amesbury's knowledge was sparse in this area. There was nothing, for example, on how sustained turbulence Gs might affect a pilot's judgment and control. Amesbury, to take the present state, the needed information, Chuck and his fellow Flight Safety engineers had to find out. Some Vought pilots would begin the Crusader's spin program. Their first job would be to wing a flat spin out of the spin fighter—of the same type.

Chuck, received U.S. C's clearance for three days of tests. Vought's Systems Test Lab modeled-up a Crusader cockpit to fit inside the centrifuge cell. In 27 miles in the centrifuge Chuck and the Vought demonstration pilot who would make the actual flight test trial spin recoveries under heavy pressure G loads. They experienced near-perfect. For example, they experienced strong mental confusion that made early simple functions possible. But before they were done, they had proved and spread relevant pilot and "dead man" operators that would use a pilot through a flat spin, should one occur.

These flight devices proved valuable, but temporary, measures. With them, test pilots were equipped for the work. They would eventually yield the Crusader to show a flat spin. Vought's demonstration program was entirely successful and proved that spin devices were necessary. The test pilot couldn't flat spin the Crusader but lose no money.

Vought's Flight Safety Engineers help improve the reliability and efficiency of military systems. They analyze systems as well as components. They are a source of operation-maintenance information, and they work closely to identify in all experiments a solution in principle of flight safety.

VOUGHT AIRCRAFT
AERONAUTICAL DIVISION

percentage of its customers are aircraft systems, it tests only systems in testbeds. It is to indicate on each Transceiver card by drawing a pencil line through the number "1" in a special circuit box on the transceiver card. (The server has computer test numbers, are through five, to permit live simulations.) The system will automatically indicate the number of "1" and the total number of operations entered over the same period, to give the desired answer.

Nicholson emphasizes that one of cards central of a keyboard for entering information into the system permits great flexibility. It is easy to provide more, less, or different information merely by changing the layout of the card and reprogramming the computer accordingly.

TCA began its study of automatic data processing techniques more than four years ago. The first model of the Transceiver was designed and built by Vought. System programming techniques were developed by RCS Data Control Ltd., Toronto. Experimental

work was evaluated, and ideas stated, using an old (by computer standards) British computer installed at the University of Toronto.

Future updates are they expect to sell the Transceiver as a computer input-output device for many other applications and currently are negotiating with a U.S. manufacturer who may redevelop the device as a traffic control system being prepared by the Aeronautics Administration based in production quantities, the Transceiver is expected to add for \$2,000 or less.

Omega Navigation Aid Could Serve World

By James A. Finck

New York—Omega, a long-range navigation system originally developed for use in British-authorized submarines, has been offered by the U.S. as a possible substitute for the guidance of air and sea navigation on a world-wide basis. System has an estimated accuracy of better than one mile at its operational range of from 5,000 to 6,000 mi.

Omega is one of the proposed long-range navigation aids presented by the U.S. at the recent Sixth Communications Division Meeting at the International Civil Aviation Exposition.

Developed by the Navy, Omega is an outgrowth of the Radon ML 1 and ML 2 systems programs which began in 1944. As previously scheduled, formal evaluation of Omega will begin in 1957 and extend through 1960 in the opinion of some informed observers, international agreement may be reached on a standard long-range navigation aid with or without U.S. co-operation before this date.

Omega is a navigational system for both air and surface navigation which operates in the 10.14 kc. band with

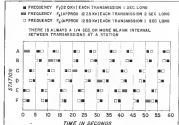
are required to determine a hyperbolic line of position, two intersecting lines of position provide a position fix. According to its developers, the advantages of the Omega system are:

- **Millions of miles of global navigation** is required to provide world-wide navigational coverage.
- **High reliability** is achieved from the proper system stability of very low frequency transmissions.
- **Line of position accuracy** of a high order which results from the phase stability of VLF transmissions.
- **Position accuracy** which is maintained nearly uniformly throughout the zone of coverage because the curvature of the earth insures that the hyperbolic lines of position do not spread as far apart when leaving the baseline as in short baseline systems such as British Decca.
- **Omega is a navigational system** for both air and surface navigation which operates in the 10.14 kc. band with

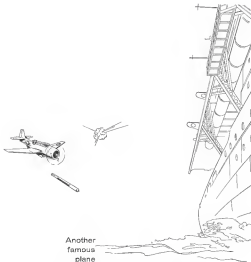
currently allocated for navigation purposes.

Original Radon program began in 1949. Test phase was the development of a 40 kc. system that used 100 cps modulation of the carrier to resolve the ambiguity (the problem of determining one cycle of phase from another) inherent in continuous phase comparison systems. This system was installed and tested in an experimental network with stations on Hawaii, San Diego, Guam, and Bimini, Md. The network has been operational since 1951.

Level of Accuracy
Radon system, with its baseline of slightly more than 2,000 mi., proved in its first evaluation tests to provide one-way accuracies of 9 mi. with 95% reliability. Continued development during the past three years has improved the figure to 4 mi. (with 95% reliability). The system has been in use



Transmission schedule of a typical in-air Omega network. Synchronization signal F_1 is not required if time is known to better than 2.5 sec. and may be discontinued.



Another famous plane PROVEN IN SERVICE

1942

Guinness Torpedo Boatmen help sink four Japanese aircraft carriers in battle of Midway Island — Japan's first losses toward end



For operations of these combat boats today require a great deal of ingenuity, skill, and devotion to duty. The men who operate these boats are the "Torpedo Boatmen" of the Navy.

In 1942, the Guinness Torpedo Boatmen were writing their thrilling chapter in the history of the world. But even then, 15 eventful years ago, Rockbestos high temperature wire was well known to the defense industry — had earned a proven in service reputation.

Long an important part of the aircraft industry, Rockbestos has been known for high temperature wire which meets the exacting standards of modern airplanes — both military and commercial.

And, Rockbestos will continue to develop wires to meet the aircraft industry's needs. Find out just how Rockbestos can help solve your high temperature wiring problems. Write, wire or phone for complete specifications and application information.

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quire a VLF antenna system capable of handling the power needed for the system. A typical antenna system would be a four tower system with three of the towers at the corners of a 1,500 ft equilateral triangle and the fourth in the middle of the triangle.

Each tower would be about 625 ft high. Tower tops would be connected by cable to impose top-loading. A 4,000 ft diameter receiver could also be used to support the type of array, and a smaller size 314 m in diameter would be required for the site.

For men who will start out within the sphere of a known point, who will give within the coverage area at all times and who will have a means of knowing time to within a few seconds a simplified receiver capable of full system receiver but not equipped with navigation or navigation system will be developed. The user will be required to know time to within two seconds and his position to within 3 mi at his start of operation.

For the user who knows time to within a few seconds but knows his start position only within 75 mi, he who cannot receive a radio signal and, consequently, a receiver having navigation facilities will be required. A third receiver can be provided for those applications where time is not known with sufficient accuracy and the receiver must supply its own synchronization.

Position needed to date has been by display of hypsometric contours on maps. These outputs, however, can be taken out as either analog or digital form and the display can be a chart display device or other special display for use by aircraft pilots or land personnel.

Lightweight Computer Designed for Aircraft

Los Angeles—Korn's Woodbridge Corp. announced today that its Computer Systems Division has developed a new digital airborne computer that is designed to provide a lightweight computer computing control center for high performance military aircraft.

Completely transistorized, designated the RW-10, employs specially designed digital computing techniques and will perform all computations for navigation, fire control, bombing and weapons control with the speed demanded by modern weapon systems.

The RW-10 was designed by the Korn-Woodbridge Computer Systems Division as a program underwritten in late 1954 under a development contract with the Air Arm Division of Westinghouse Electric Corp., Baltimore, Md. Objective of this program, just completed, was to develop a system which would perform reliably in an

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Double-acting PIP Pin combines tapered strength and dependability with INSTANT DISSECTION, AUTOMATIC SELF-RETRACTING...QUICK RELEASE! It's the most dependably self-loading quick-release pin you can use!

Now... eliminate nuts, bolts, nutter pins and other retaining devices and save unlimited design freedom by using double-acting PIP Pins to fasten units that must be assembled and disassembled frequently. PIP Pins permit quick-change of mechanical units, speed assembly...reduce scrap rate.

Double-acting "B" Series PIP Pins have the special advantage of the exclusive PIP "drive-in"-"drive-out" feature...makes it easy to install or remove when installed holes or extra loads cause "binding".

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Double-acting PIP Pins are used by leading manufacturers of industrial, electronic, constructive and materials handling equipment. Used by every major aircraft manufacturer.

PIP Pins with "drive-in"-"drive-out" features are available in standard dimensions to fit most current holes. "B" Series double-acting PIP Pins with coniform steel ring are particularly adaptable to remote release systems.

Let our Engineering Staff help you determine the correct solution to your quick-release fastener problem.



Circle fitting. Tube assembly. Bracket assembly.
OTHER FEATURES...INTERCHANGEABLE NUTS for zero hole step of thickness. NO SPRING. COMPLETE STRUCTURAL AND FACTORY DATA.

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environment of glassed tubes, without scrub-off, one which presents a high degree of flexibility and maximum size, weight and power consumption.

New control computer calculates computer speed, with selection in size, weight and power consumption. The complete computer has a volume of 1.19 cu. ft. and weighs 25.5 lb. It consists of four specially produced anti-magnetic drive, storage unit, electronic and control unit, input-output unit, and clock generator and power supply and semiconductor packing techniques in which semi-conductor circuitry are used throughout.

The RW-10 is described as the latest release negative drive computer in operation today. It can conduct 1,000 complete arithmetic operations per second, including access time, and requires only 40% of power, permitting a significant saving in circuit auxiliary power equipment.

Expansions, Changes
In Avionics Industry

Maxine Colburning Machine Co., Orange, N. J., latest acquisition of Lerner Industries, Los Angeles, is expected to provide a marketing and service organization for electronic digital computers developed by Lutron. The company entered under a stock exchange agreement approved by Morris Industries (NYSE: 70, p. 60). With other recent acquisitions (Aircraft Radio Corp. and Marshall Electronics), Lerner's annual sales are expected to run around \$100 million annually.

Other recently acquired equipment, weapons and changes in the aircraft industry include:

• **Savage Arms Corp.** will produce Aircraft Ammunition, Inc., Baltimore, in a move intended to diversify the former's commercial business. New equipment includes about 100 and has operated in defense work since its formation in 1970.

• **Ryan Aeronautical Co.** will move its aircraft division to 30,000 sq. ft. facility on Kramer Mesa, near San Diego. Ryan is in pilot production on Doppler navigation system and ground speed indicator for Navy, Army and Air Force.

• **Dalaco Victor Co.** has formed new business division to exploit developments in the field. R. J. Stahl is manager.

• **Hilde Electronic Products, Inc.** (Patent, N. J.), is adding 15,000 sq. ft. of new facility to existing plant.

• **El-Tonaco, Inc.** (Philadelphia, Pa.) purchased the Philadelphia Machine

MICRO-BEARING
ABSTRACTS

By A. N. DARRILL, President
New Hampshire Ball Bearings, Inc.

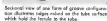
BEARING FITS AND
FITTING PRACTICES

As shown in Fig. 2, the fitting of Micro-Bearings, like the fitting of lower ball bearings, clearly involves the clearance between the inside diameter of the housing and the outside diameter of the ball bearing, the size of the bearing and the shaft diameter.



The achievement of the desired fit by determining as illustrated in Fig. 2, the bearing ID is represented by the top block and the shaft OD is represented by the lower block. Such a block diagram could also be applied to bearings and bearing outside diameter in that block diagram, it will be noted, the hole cut ID is represented by a 0.0015 tolerance with a clearance tolerance for the shaft, a machine fit of hole to line to hole, hole to line, shown.

1. Housing ID 12.000 12.001 12.002 12.003 12.004 12.005 12.006 12.007 12.008 12.009 12.010 12.011 12.012 12.013 12.014 12.015 12.016 12.017 12.018 12.019 12.020 12.021 12.022 12.023 12.024 12.025 12.026 12.027 12.028 12.029 12.030 12.031 12.032 12.033 12.034 12.035 12.036 12.037 12.038 12.039 12.040 12.041 12.042 12.043 12.044 12.045 12.046 12.047 12.048 12.049 12.050 12.051 12.052 12.053 12.054 12.055 12.056 12.057 12.058 12.059 12.060 12.061 12.062 12.063 12.064 12.065 12.066 12.067 12.068 12.069 12.070 12.071 12.072 12.073 12.074 12.075 12.076 12.077 12.078 12.079 12.080 12.081 12.082 12.083 12.084 12.085 12.086 12.087 12.088 12.089 12.090 12.091 12.092 12.093 12.094 12.095 12.096 12.097 12.098 12.099 12.100 12.101 12.102 12.103 12.104 12.105 12.106 12.107 12.108 12.109 12.110 12.111 12.112 12.113 12.114 12.115 12.116 12.117 12.118 12.119 12.120 12.121 12.122 12.123 12.124 12.125 12.126 12.127 12.128 12.129 12.130 12.131 12.132 12.133 12.134 12.135 12.136 12.137 12.138 12.139 12.140 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B. B. and Poulton: *Tringa discolor* and *Tringa*

Sectional view of one form of groove configuration illustrates ridges raised on the tube surface which hold the female in the tube.



Completed rigid tube joint made with two ANCA ferrules, gasket and AN756 swirl flange.

Write on company letterhead for technical data.

ICBM Feeling Tests

400 intracranial balloon occlude during operation is facilitated by test occlude to check sections of typical 800 Fuzz clamps who will operate the occlude. Test is part of human research study in Congress at Stanford, 400 University Avenue, Calif., Inc.

Corp., New York, president of electro-mechanical products. W. H. Hurd, former president of new acquisition, will remain in consulting capacity.

• Westinghouse Electric has opened new warehouse for inventory tables in Dallas at 481921 Reading St.

• **Kaiser Industries Corp.** will purchase assets of **Kaiser Aircraft & Electronics Corp.**, wholly owned subsidiary of **Willys Motors, Inc.**, which will be operated as division of the parent company.

• Raytheon's Missile Systems Division headquarters will move in November to new 40,000 sq ft facility in William Industrial Park on Route 178, near Boston.

period to reduce flight crew fatigue from noise risk and to enhance smoke protection by avian equipment failure from the cockpit area. Prior to adoption of low-noise cockpits, at least one flight crew complained that high ambient temperature created by avian equipment "caused discomfort to shorten their visit to the flight deck," Ellison asserted.

• **Mergers, Mergers Everywhere**—Two large independent West Coast window manufacturers are deep in merger talks. Huddle. If merger goes through, it will point as signpost to many old hives in the business. Combined company would have total annual sales of around \$100 million.

• All the Contents of Home-Traffic controllers also mean the rules consist of Civil Aviation Adaptations: new or toxic surveillance radar (ARSR II), new under construction at Karlsruhe, will find better radio capabilities and safety.

► **Reliability Gains Figs**—New test and design procedures which Defense Dept. hopes to introduce into future development and production contracts to improve reliability (AW Aug 5, p. 34) will be tested out first by all three military services. Each service will select several new development

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STPH Series



STPL Series

MICRO SWITCH or Sealed precision switches are a completely new design. Rocker actuation makes switching easy, yet fails or accidental actuation is impossible in a vacuum.

The inseparable actuating rocker is made from either clear or clouded plastic. In the clouded, only the ends are clear. From a light source inside the panel, light from the clear end indicates rocker position which is highly advantageous in critical panels. (Data Sheet 102.)

LEVER-ACTUATED



STPL Series



STPL Series

MICRO SWITCH or Sealed precision switches are for applications which call for unusual reliability and long-life performance.

Toggle levers are of radi chrome-plated brass with anti-corrosion treatment. Contacts are of disc-cut aluminum. (Data Sheet 103.)



STPL Series

ELECTRICAL DATA

Rating Loading	Resistive Load				Inductive Load				Solenoid Load			
	30vdc	115vdc	250vdc	915vdc	30vdc	115vdc	250vdc	915vdc	30vdc	115vdc	250vdc	915vdc
STPH-S	80 amps	15 amps	5 amps	25 amps	8 amps	17 amps	4 amps	10 amps	10 amps	10 amps	10 amps	10 amps
STPL-S	20 "	75 "	5 "	25 "	5 "	8 "	4 "	10 "	10 "	10 "	10 "	10 "
STPL-S	20 "	75 "	5 "	25 "	5 "	8 "	4 "	10 "	10 "	10 "	10 "	10 "
STPL-S	20 "	75 "	5 "	25 "	5 "	8 "	4 "	10 "	10 "	10 "	10 "	10 "
STPL-S	20 "	75 "	5 "	25 "	5 "	8 "	4 "	10 "	10 "	10 "	10 "	10 "

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A silicone seal between the push button or lever actuator prevents entrance of dust and moisture into the switching chamber. A liquid moisture, which never hardens, seals switch case to cover. Switch will withstand 30 psi of pressure differential.

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Available in standard types.

progress and several organizations about to go into production to some in press paper. Progress is sponsored by James M. Rogers, Director of Elementary Office of Assistant Secretary of Defense for Research and Engineering.

•Calling All Authors—The 1958 Electronic Components Conference, to be held April 22-24 in Los Angeles, is seeking prospective authors. Abstracts of proposed papers (200 words), plus background information on author(s), must be submitted by Nov. 15. Send abstracts to: E. E. Brown, Room 6-10, Geneva, Boston, Calif.

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•Sevenshield magnetic type recording high shock, designed for use in aircraft, was 28 microseconds and can be controlled directly to thermocouples to record without use of amplifiers. Read



it will be manufactured to withstand high shock, and vibration forms as well as high temperature and thermal shock. Aluminum head features gap alignment system less than 0.1 mil. tape guides aligned with the head. Manufacturers: Data Storage Devices Co., 7015 Sunset Ave., Van Nuys, Calif.

•Electronic shippers, No. 31308, meets requirements of MIL-STD-2000, and is used to have a maximum operating life to excess of 5,000 hr. Shipper features zero phase shift frequency



range from 40 cps to 20 kc, ambient range from -55 to +125°C, accuracy $\pm 1\%$ in diameter by $1/8$ in long. Manufacturers: Corbin Co., Inc., 1775 Main Ave., Clifton, N. J.

•Constant torque, Type 4CX1000A, is a high current, low voltage rated beam toroid with high gain and a plate

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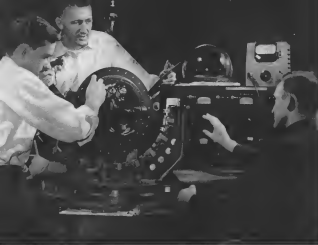


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dimension of 1,000 in. Specifically designed for single additional operation, tube is a Class AB, of an all metal amplifier. It achieves maximum rated output power with zero grid drive, simplifying drive stage design. Johnson Manufacturing Corp./McCulloch, Inc., San Bruno, Calif.

• **High temperature electron rectifier.** Model 2550T735, especially designed for aircraft use, meets MIL-P-7127B Rectifier at a 6 phase, full wave unit with a rating of 100 amps at 25 v., will



operate at 125 C ambient temperature, weighs 5.5 lb and measures 5 in. x 6 in. x 6 in. Manufacturer: Compensated Devices, International Telephone and Telegraph Corp., 100 Highland Rd., Clinton, N. J.

• **See 15 modules.** Model 3332V has ±0.1% accuracy from -55 to +55C (with supplies), with broad experience of 10,000 hours. Cert has been designated by Navy, AEC and AEC-4, Major E. With for Bulletin No. 415 from Nucleon-Kelby Corp., Cosmopolitan Bld., Stamford, Conn.

• **Stainless steel models.** Series P-990, containing complete balancing circuitry have been designed for use in nuclear and space electronic systems. Models are available in a range of sizes and in rugged commercial models or military



version meeting MIL specifications. Units will operate at ambient temperatures to 115C and at altitudes to 60,000 ft. Manufacturer: North Atlantic Industries, Inc., 605 Main St., Westbury, N. Y.

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Reinforcing Flexible Coupling



Controlled Air Source Units



Universal Seals for Pressure Seal Units



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Controlled Air Source Units



FARSIDE being cradled on its launching truck. Framework from which rocket assembly hangs vertically below before can be seen.



LAUNCHING truck about to start roll toward the before after it is lit up.

These pictures of preparation and firing of Farside before launched sounding rocket on Everest. As it is the Pacific show how casting solid propellant rockets was immediately assembled into a 4,000 m. straight-up deep-probing vehicle. At least one and probably two of the USAF vehicles launch signs with their 50-lb. payload are believed to have reached the 4,000 m. altitude (AF Oct 26, p. 31). Transmitter failure was reason for altitude uncertainty. Ballast went to 130,000 ft. was super test since the typically short, fast rockets

tons of solid propellant rockets—all four stages were tested out in eight seconds—mean that the 15,000 ft./sec. terminal velocity was reached in a short time and the resulting aerodynamic heating at the non-accelerated period, if launched from the ground, would have been prohibitive.

The 30-ft. long vehicle consisted of four Flitcraft Rocket rockets for the first stage, a single Rocket for the second stage, four General Central Arrow-type rockets for the third stage and a single Arrow type for the final stage.

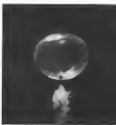
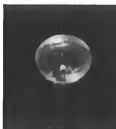
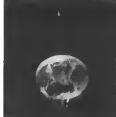
Farside Assembled for 4,000-Mi. Flight



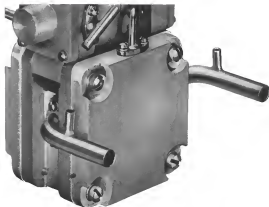
LOFT and nozzle, two views of the 10-lb. payload and nose cone covering, and right, those of the first stage rockets in place.



LAST stage rocket, payload on its side, is slipped between the four third stage rockets.



ROCKET is fired through before 70,000-100,000 ft. up. Bottom photo shows rocket's flame before before. Middle, 50-lb. vehicle is inside 200 ft. dia. balloon. Top, vehicle is 250 ft. above before.



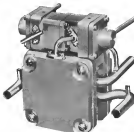
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Raytheon feels our word is worth its weight in gold. It's worth more when you recognize that today's aircraft and tomorrow's missiles have similar functions and require similar controls. Often, a precision control developed for one has applications in the other.

Come to pitch the Tactair servo amplifier, the "intelligence center" of the modernizer's new Tactair T-30 Navigator. The extreme life-length and high sensitivity of this new, completely precision-cut give the complete superior flight characteristics, faster control, half the weight and cost of conventional types.

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Remember: as standard or special components, let us make you with your next precision valve problem. Every job we do is done on a precision basis. It has been that way for 16 years. Tactair Valve Division, Avco Products Company, Bedford, Pa. BRoadway 5-1180.



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PRODUCTION BRIEFING

Extensive plans of 12,000-ton capacity in new operations at Hanford, Moscow, Tennessee, Calif. Part of the Air Force heavy program, plans for overall length of 306 ft., weight 4,000,000 lb. It can extrude aluminum airframe from ingots 12 in. in diameter and 75 in. long.

Ryan Aeronautical Co. will move its aircraft plant at San Diego to a 50,000 sq. ft. building at Kearny Mesa north of downtown San Diego, near new Convair Aerospace Division plant. Later electronic facilities of more than 200 employees will move into the Kearny Mesa building.

Wardner Works, Inc., Garden, Calif., says that among its other units, Thompson hydraulic turret valve will convert old machines into modern



electronically controlled grinding and contouring machinery. Plans show a complete installation which it can roll speed production and build profits.

Bedding Corp., Wilkes-Barre, Mass., expects that the \$2.5 million in contract casting research in which it has invested in the last 10 years will double its sales to \$4 million by 1960. President Robert A. Weaver, Jr., and that the firm has now casting which will protect metal against temperatures of 2,500° and up.

U. S. Steel Corp. says its Duquesne, Pa., works have successfully made large commercial castings in vacuum technology. To form the vacuum which eliminates harmful gases from the molten metal prior to forming the ingot, a 17-ft. diameter, 90-ft. high vessel is placed over the mold and an air removed by four large pumps. Ingots up to 85 in. in diameter and 100,000 lb. can be cast this way according to U. S. Steel. The company said that in addition to greater steel quality before shifts for the electrical industry, the process would be applied to parts for high speed aircraft.



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BUSINESS FLYING



LAMINAR FLOW low-drag radial engine gives Comanche good speed, range on only 160 hp. Later 200 hp. version will be 25 mph faster

Airman Week Check Flight

Comanche Shows Stability, Ruggedness

By Robert I. Staefeld

Look Here—New five-place, single engine, PA-24 Comanche is a stable, comfortable, high performance airplane with the same low toth characteristics as its Piper brethren, Arrowair Wings, based on its flight evaluation.

Comanche, less performance of the low-wing, attractive airplane to

• **Laminar-flow wing section**, developed by National Advisory Committee for Aeronautics (NACA) June 11, 1956, p. 1051

• **Horizontal stabilizer**, a single-piece, girth, surface hinged at about 18% of mean chord that moves in its center

• **Power-boosted** Lycoming O-360A1A engine which develops 180 hp at 2,700 rpm, at takeoff

Engine responsiveness ratio is 3.5 to 1, fuel grade is 91 octane. Engine is equipped with constant speed exhaust system developed by Piper. Section goes



ROAD FEELING gives Comanche a cabin resembling 44% in side baggage compartment with 30 cu ft of space. Long-span flaps are over 180 in; Super Bow wingover Apache



COMMANCHE INTO CLOSE to ground permitting easy access to cabin without needing step to wing. Global exhaust free design.

valves scavenging of exhaust gases for maximum power on takeoff. Standard steel exhaust manifold is provided.

Standard equipment includes constant-speed, controllable propeller which, in the case of the demonstration, was manufactured by Hartzel. Some models will come equipped with the 4th lighter McCulloch propeller.

Rugged and Low

Roughly built airplane is designed to withstand ultimate load factor of 7.9Gs. Airplane sits low, allowing for easy step-up to cabin and one maintenance of exhaust and engine. Height from ground to leading edge of wing, for step-up, is less than 18 in.

Big cabin door—36 in. wide x 11 in. high—makes for easy access to airplane. Roomy cabin is 44.5 in. wide. Rear seat has adjustable seat back. It can be quickly moved to the upright baggage area. Baggage compartment, 20 cu ft, is all of one unit and is reached through separate outside door measuring 20 in. x 22 in.

Front cabin seats are 45 in. apart and can be adjusted over range of 6 in. Cabin baggage, door to leading edge, is 36.5 in. front and leg, considerable freedom to stretch before during long flights.

Flight and Starting

Airport was pulled up at New York for cruise to Lack Hoven, Pa., where further flight evaluation was conducted. Cessna Comanche and its evaluation was first production model, N5000P. Dry weight of airplane is 1,445 lb. With short 49 gal. of fuel 8 qt. of oil, 40 lb. of equipment and three people plus light baggage, airplane grossed about 2,250 lb. Maximum allowable gross weight of Comanche is 2,190 lb. useful load is 1,300 lb.

Wind was from the north, 16 to 20 kt., and sea level pressure was 30.05 in. (30.05 in.)

Propeller and starting procedures are simple. Instrument checklist for takeoff



CUSTOM MODEL and accessories has full gyro (front of instrument) work, Super Comanche will have dual ADF-12E and Navstar Ma. 3 Computer. Panel face is vacuum formed plastic.



TAIL GROUP features composite "shelving" wing stabilizer having adjustable stabilizer tab to provide correct roll and balance. System requires about 2000 lbs. less than a one ventral horizontal tail. Piper says: "Ruders are swept to give plane another look



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and landing is located at top of nose-wheel well, beneath center of inertia mount panel. Instruments, speed over wheels, shock-mounted panel, and dual flight controls, are accessible to both pilots. Sparrow runs across bottom of lower fuselage which, on pilot's side, are located on the fuselage.

Engine quickly finds up after nose-pose down. Engine instruments rest right in the gunner's position; fuel pressure and oil temperature.

Cockpit switches is good to all sides. Unusually wide track of gear, 4 ft. 9.5 in., coupled with large nose-wheel all wheels, main and nose, are equipped with same size 600 x 6 two-cable tireing light and smooth.

Sparrow is based over frame strip and rolled ends, across nose-wheel and with little passing around. Landing gear is not jacking. Cleared angle of attack, 10 degrees, are operated by single hand brake that hangs down from left environment panel.

Light pressure was required to activate parachute which, when extended, engages with rubber pilot system. Nosewheel travel runs 25 deg. left or right. When down is extended, landing gear has no danger to lighter roller feet.

Below tailfin elevator trim was adjusted, we reviewed the landing. And roller from back, located on right side of nosewheel housing was run to tailfin right to combined tailfin target effect. American electric fuel pump and the tailfin and landing, was installed on.

Standard tailfin was made with no flap and full power. Sparrow nose wheel is not movable down runway, with minimum of outer control. At 60 mph nose-wheel looks ground and Comanche nose wheel is 700 ft.

Comanche quickly within 100 ft. nose wheel and engine checked out. Fuel tank at 95 mph, 145 ft. Rate of climb was 1,100 ft. per min., pulling 28 in. MP and 2,800 rpm. PA 24 increased on north. Roller has only capacity speed for target. Despite single angle variable command good.

Missile Control

Missile control was accomplished during climb with engine control being retained until engine was 100 ft., then advanced until acceleration was noticed. While landing a nose effect at 1,000 ft. and above, application of lower altitude allows for lower fuel consumption and still won't allow engine.

At 5,000 ft., pulling 25 in. MP and 2,400 rpm, holding 95 mph, 145 ft. rate of climb was 700 ft. per min. Sparrow was checked at 5,000 ft.

With power reduced to 75% at cruise altitude—27 in. MP and 2,100

rpm—Comanche held 160 mph. PA 24 stability during climb and cruise was excellent, little time application was necessary.

Flight to Lack Haven was smooth and comfortable. Hanging roller pods, which leave flow clean, give ample room for stretching. Sparrow engine link control pressure during flight. Sparrow's engine link control pressure during flight.

Comanche's good flight characteristics are attributed to laminar flow wing and 8-in. tail or stabilizer. Laminar consists of single-piece horizontal surface that moves in its motion, when control wheel is moved forward and aft. Self-compensating tab system, tab extends nearly full length of leading edge and can be adjusted in flight to compensate for loading variation.

Horizontal stabilizer area—72.5 sq. ft.—is 30 to 25% less with stabilizer down with conventional surface, according to ship's chief design engineer, Fred Strickland. Ratio of movement between stabilizer and tab is 1 to 1.5. Pilot can change rate of movement to get on control surface at what he needs it.

Cruising Range

During flight, which included extensive maneuvering and varied power applications, fuel consumption averaged 18 gal. per hr. Fuel is carried in two 10-gal. rubber fuel cells on each wing. Standard fuel supply is 50 gal. for normal low-power operation. For additional range, 10 extra gal. can be carried through filler neck which extends about 10 in. into the tank.

When rolls are filled to bottom of filler neck, each tank holds 23 gal. When filled to the top, each holds 10 gal.

Piper lists the following 5,000-ft.

Piper Comanche—Model PA-24

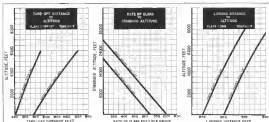
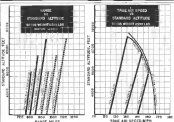
DESCRIPTION

Engine	Lycoming O-590 A-1
Hp and rpm	180 at 2,700
Gross weight (lb.)	2,550
Empty weight (lb.)	1,440
Useful load (lb.)	2,180
Wing span (ft.)	36
Wing area (sq. ft.)	178
Length (ft.)	24.7
Height (ft.)	7.3
Power loading (lb./hp.)	14.2
Wing loading (lb./sq. ft.)	14.3
Stagger (average) (ft.)	1.85
Fuel capacity (standard, gal.)	50
Fuel capacity (with reserve tank, gal.)	60

Optimum cruising speed (75% power, 5,000 ft., mph.)	160
Stalling speed (flaps down, mph.)	51
Takeoff run (ft.)	750
Landing roll (flaps down, ft.)	400
Roll rate of climb (ft./sec.)	96
Rate of climb (ft./min.)	950
Service ceiling (ft.)	15,500
Max. altitude (ft.)	21,800
Fuel consumption (75% power, 5,000 ft., gal./hr.)	30
Cruising range (standard fuel, 75% power, 5,000 ft.)	5 to 500 mi.
Cruising range (standard fuel, optimum, 5,000 ft.)	6.5 to 575 mi.
Cruising range (reserve fuel, 75% power, 5,000 ft.)	6 to 560 mi.
Cruising range (reserve fuel, optimum, 5,000 ft.)	7.5 to 1,100 mi.

PERFORMANCE

Top speed (mph.)	187
------------------	-----



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The flat Ellipse and button head configurations shown here are two examples of additional head styles available in a full range of sizes. The small heads also offer important weight savings... for example, the 1/2-28 flat Ellipse head with a head height of .180 and a .375 diameter will accept the TORQ-SET design and deliver driving torque for as many as 100,000 cycles.

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(crossing) torque figures for Conquest:

- Standard head (10 g.p.i.) 75% position on 5 lb. 3-oz.
- Standard flat, economy crane-218 wt. on 6.2 lb. flying
- Reverse head (60 g.p.i.) 75% position on 6 lb. flying
- Reverse flat, economy crane-1108 wt. on 7.5 lb. flying

Head selection value is on face between pilot seats and may be checked visually by the test. Head faces in gun are from 100% to 1000% below pilot's seat, low spot for clearance. Positive drive means torque being lost to screw itself when pump take over. During cruise flight at 6,000 ft. gun was reduced to 15 in. MP and 1,900 rpm. Indicated speed decreased slowly due to clearance of airplane and fuselage held constant at 120 mph. With setting of 15 in. MP and 2,300 rpm, speed held at 110 mph indicated.

Stability and control characteristics remained good during slow flight. Paper again illustrates the importance of fast of bracket face wing.

Position stills were accomplished at 5,600 ft. With 25 in. MP, 2,300 rpm, gun and flap in, airplane was pulled nose high. Conquest, pulled well ahead of wing, back came about 62 mph IAS. Using standard recovery procedure, minimum loss was less than 300 ft.

At cruise power setting, gun down and no flap, and gun down with full flap, airplane stalled out at 65 and 75 mph IAS, respectively. In each instance there was only one stall buffeting and almost a complete loss of the airplane to the gun. External stability was excellent, slight rudder pressure compensating for minor falling off of wing.

Power-Off Stalls

Dropping down to 6,000 ft., nose over of stalls was accomplished with power off. With gun up, back blown and no wing flap, nose on when power is reduced to 10 in. MP.

With gun and flap up, airplane stalled at 65 mph IAS. Gun down, with no flap and full flap, stall speeds was 60 and 58 mph indicated, respectively. At all configurations recovery was initiated with acceptable loss of altitude.

Holding airplane nose high, gun and flap down, no deliberately induced a series of stalls, backing down one and taking into the effect, without applying power.

As before, proposed using, long of trade in it was, but retaining local stability at all times.

Final approach, still, emphasizing safety aspect of airplane, was initiated with airplane in landing configuration. Gun and flap were down, gun set at 15 in. MP and 2,300 rpm. Airplane

was pulled into 10 deg bank, nose high and light turn initiated. Advance pedal holding again increased well ahead of stall and recovery was made with only 60 ft. loss of altitude.

Quick Descent

During Conquest a roll-out at 200 mph it does not tend to build up as cruise, dangerous speed in descent. To get down in a hurry from 6,000 ft. we dropped gun and full flap. With throttle back and gun at 2,200, rate of descent was 2,800 fpm. Indicated speed was but 110 mph.

Final to landing, airplane was slowed to 90 mph on base, and flap were

loaded one notch, about 9 deg. Flaps were then extended position-8, 18 and 27 deg. with full flap were wanted for landing.

With speed reduced to 55 mph on final, airplane control and stability, as seemed good. With full flap and into approach airplane descended smoothly. Wind was negative, and slight lift was encountered over the fence. After clearing a bar, airplane settled nose and was brought to stop in flight, over 500 ft. from touchdown, using minimum of landing strain.

Short field landing was initiated with 18 deg. of flap extended. Second flap position got airplane off ground at



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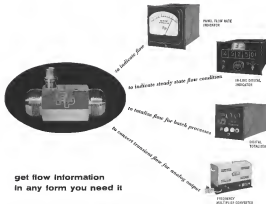
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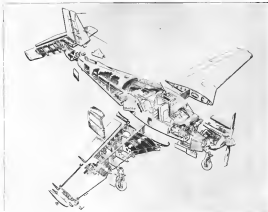
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COMMANDER AIRFRAME is stressed for 75G load factor. Large main spar passes through cabin at floor level and is splined under wing. For production conversion, five skin girds are formed. Engine mount uses gear loads are passed through frame to fuselage.

about 60 mph in about 180 ft. Little lift-off was evidenced when Eps were raised after takeoff.

Because altitude was low to ground, tendency to land in to level off on high side. With no wind, air light and from the side, no turbulence during evaluation. Landing tendency is developed which, at times, sets up runway. Until familiar with landing characteristics, it proved quicker than it does can be accomplished through at fixed Eps extension.

Wide gear holds airplane wing to ground. Safety switch located in left main, activated by weight of airplane prevents gear collapse on ground should gear handle be accidentally dropped.

Emergency Extension

In the event of electrical failure in flight, gear may be extended mechanically.

This is done by lifting floor plate and disengaging gear motor. Retracting gear lever, located on floor between plate seats, is then extended to full length and moved left forward.

Gear will drop into full down position. Gear cannot be checked visually in flight. However, in addition to horn and light are now visually observe slow forward on left movement of door being emergency gear lever which turns in clockwise gear switch is Epsol. "Not also can 'lost' the locking of gear as it falls into place.

Three Models

Cessna, as is the rest of the Port line is offered in three models: Standard, Custom and Super Custom. All feature two or four seats, standard standard model is priced at \$14,990 without radio equipment or basic flight instruments.

Custom Commander has Naco equipment with VOR navigation and VHF receiver and 12-channel transceiver with nine crystals in standard, low frequency receiver with separate power supply, headset mike and two antennas, plus following flight instruments: altimeter, horizon, directional gyro, electric turn and bank, rate of climb, clock, outside air temperature

gauge, vacuum pump drive and vacuum pump.

Super Custom Commander has all equipment of Standard and Custom, plus Naco Oxygraph, 10 ft. VOR, ILS, VHF and with 17 channel transceiver, 24 crystals standard, in place of Super Custom and low frequency receiver and Low ADF 12E (Automatic direction finder). This model would give about 30 lb. in take weight over Custom.

Electrical provisions include a 12-volt system with 31 amp hr. battery mounted in fuselage for more room. A 35 amp generator is standard equipment with optional 50 amp generator. Included are instrument panel lights with dimmer, cabin speaker and headlight and side panel.

Standard lighting includes navigation, instrument, and fuel and low color dome lights, plus a landing light mounted at extreme end of each wing.

Landing Lights

Wing tip landing lights act as offset. These advantages.

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Cessna 340 in 440 BAGGAGE BIN is part of full-circuit conversion which includes radio, navigator and new air conditioning unit.

RADIUM STEREO is an audio system for cockpit and is the same as the 60-cubic ft. baggage bin conversion in a Cessna 340.



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Navigators lights include two red lights, located above and below stabilizer, which has travel range of 11 deg (pitch or normal nacel) up, and 25 deg (pitch or normal nacel) down.

All windows are protected with scratch-resistant treated broken. Overhead and forward panels are made of U.S. Rubber "Rayflex" treated plastic.

Four color ventilation panels, each passenger with separate vacuum of outside air. Each has a check-stop dial which regulates amount of incoming air and direction of flow. Cabin heater and defroster, engine heater, four exhaust and four fuel lines also are standard equipment.

Avionics run in standard color combination, white with blue, red or black. Instruments are styled in two-tone model, using scratch-resistant Teflon as main protective material.

Piper expects to see Comanche production in one month per day in December. There even has production models and two prototypes flying at this writing.

Within the year, company expects to be out with the first production model of its 250-hp Comanche (AW Nov 26, 1976, p. 95). It will be replaced by the 300-hp Comanche engine. Airplane is expected to be 25 mph faster than the 180-hp model.

Piper official stated that the 1978 Comanche will gross about 2,500 lb., compared to present 2,150. Company expects present airplane to take extra weight and speed of new engine with only slight modifications necessary.

Structurally, the Comanche is designed for high-altitude performance—the company expects to take out five ac-

planes a day eventually—and also for ease of maintenance in the field. A prime objective was to develop a good basic airplane with a long life life. One official told Aviation Week that he believes there is available a market for, between 5,000 and 10,000 Comanches during the airplane's production life.

As regards production, the airplane is completely new and has nothing in its design or construction with previous Piper aircraft.

An indication of Piper's plans to produce large quantities of its new four-seater is evidenced use of factories in place of hangars—the opposite of what was done in the Apache. Company has



Czech Heli-Baby Exhibited at Prague

Ultra-light Czech helicopter, designated the HC-1 Heli-Baby, taking part in an engineering exhibit held on the roof of a showhouse in Prague (below). Two jet helicopters, displayed in a group under the same exhibit at the Research Institute of Aviation, has a top speed of 75 mph, range of 111 mi (AW Sept. 3, 1976, p. 75).



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instrument systems to the largest liquefaction ever built for gasification at extremely low temperatures.

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New Travel Air Line Gets Rolling

First photo of Boeing Aircraft Corp.'s production line for its new four-place light twin Travel Air shows most of the aircraft on final assembly just before the side lines of the company's first glass single-engine Bonanza (right). First Travel Airs are scheduled to go to customers in 1958, with price for basic airplane being \$49,500. Addition of new model will give Boeing Distribution a line of four business aircraft, of which three—Travel Air, Twin Bonanza and Super 18—use two engine types.

found that an large volume output, instead higher cost of buying dies is more than offset by being able to smelter this expense compared to contracted cost of X-rayed castings. Pratt says that the reason for use of castings is the Apache was that the company never expected to build as many of these airplanes as it has. Pratt has already purchased 1,200.

Location of Fagings

Trapping are explained as the leading gas bearing, port attachment point in the wings. Helium weight to which its helium control tubes are attached and T shaped fitting over the stabilizer control tube. Now gas drag lock, a constant bearing that requires only drilling of four holes to attach to the fuselage. All aluminum forgings are supplied by Kaiser Aluminum.

Fagings, comprises three major assemblies: forward portion comprising outer and baggage compartment, made in upper and lower sections, and a single-piece aft fagings, topped by a separate tail cone.

Lower forward fagings section contains the structural bulk of the airplane. Two heavy longitudinal beams of flat sheet stock run from the forward bulk on either side of the fuselage wall, decrease in height to join under the main spar and continue as higher spars to the rear of the baggage compartment. These beams take all load-

ing gear loads from the nose wheel and provide the lower fagings with good bending stiffness, also act as a lead to shock belly loads in event of a wing-drop landing.

Another part of constant thickness flat stock hot section beams run from the upper forward bulk, along the ribs of the fagings, sitting up at the rear ends and strengthening, not over the baggage compartment. These are continuous from the forward to the front of the baggage compartment—a splice occurs to the rest of the section. Beams handle engine mount bending loads, also reduce main bending loads applied by nacelles and door sections in the upper portion of the fuselage.

Sections Easily Replaced

Rear section of the fagings is composed of constant-thickness beams attached by semi-concrete shear doublers. Rear and forward fagings assemblies are attached simply by bolting lower fagings into overlap to rear fagings skin. Such overlap makes it possible in event of extreme damage to rear of the fagings, to replace whole section here by removing attacking rivets and without having to cut through major fagings structure.

Winging is done with relatively small size flat stock—only formed skin sections in the entire airplane are the cast, jet doors, tail cone, engine cowling and wing tips. Basic skin is .025, although

under the fagings, between the spars, thickness increases to .031.

Tapered wing is a low-wing, low-wing configuration offering National Airlines' Chief Engineer for Northwest 642A215 (aircraft section through) Main spar runs forward to top and bottom extrusions at spar tips out to about two-thirds of the span, conventional channel sections out to the tips. Stringers, cut in 12-0 lengths, are built section.

Wing Assembly Techniques

Wings are assembled on forward and rear section jigs. Skin is wrapped around the nose section and formed to the main spar cap strip with holding rivets. When forward and rear sections of wing are assembled, main spar is shaped under the lower skin and structural riveting is done through the skin and spar caps. Technique from nose and rear wing section jigs to main spar assemblies, with final jig used to tie all sections together.

Wing is then moved to its final, as the main spar which is about 45% of the main chord.

Main wing spar goes through and along from corners on the sides of the fagings, built together under the main spar and are covered with top and bottom splice plates to form a continuous spar from wingtip to wingtip. Front and rear spars have fittings built up of flat stock. There is a wingtip rib



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Fiat G-49 Makes American Tour

Fiat G-49 trainer, shown here at LaGuardia Airport, has made a round-trip tour of North and South America. Two 126-gal. wing tanks were added for the trip. The aircraft also has ventral and dorsal gun. Fiat is Coda. Miami Herald.

area structure connecting main gun to a fuselage center, through structure at the rear spar to dissipate wing section loads on the main spar. Wing spar runs from 851 at the roots to 475 at the tips.

To facilitate field maintenance, the landing gear center line assembly and main strut and fork assembly are interchangeable in all three positions, nose and main gear. Main gear assembly is interchangeable on the main landing gear only. Landing gear can be changed on the Cleveland bridge without having to disconnect hydraulic lines and blocking fluid.

Interchangeability is also possible with both tailcone-main gear component so that the two-piece balance night vision is reversed in the event of a push-out.

Two Ocean Crossings Made by Piper Apache

Piper Apache light twin recently completed a 21,000-mi. tour of Europe, the Middle East, Africa and South America during which the engine crossed the North and South Atlantic. According to pilot Dan Wolcott Jr., the type was made without breaking the engine except to fill the tanks and make one oil change.

Wolcott was accompanied on the trip by his wife—except for the ocean crossing, which she made by scheduled airline so that extra fuel could be carried in the Apache—and Frank Bennett, Coda Cola executive. Trip took just under three months to complete and totaled 140 flying hours, of which approximately 175 was on instruments.

Airway bookings gave the plane a 29-hr. range on ocean crossings. North Atlantic flight from Canada to Liverpool, Ireland, was made in 14-hr. backing headwinds all the way; the

South Atlantic crossing took 17 hr. via Dakar, Senegal to Recife, Brazil. Navigation and communications equipment included a Lear ADF, Sauer South Instruments radio, and Niles M-11 Observer and Skyplot.

PRIVATE LINES

"Arbiters Alphabet Soup" is 40-page booklet explaining 2,500 common trade abbreviations. Available from Lott,

Inc., 1271 N. Bondy Drive, Santa Ana, Calif.

L. B. South Aircraft Corp. opened a million-dollar, 50,000-sq-ft facility at Miami International Airport for overhaul and modification of business, military and military aircraft and equipment. This new complex, 1,000 and built on several parcels of 54,775,000 ft. started operations in 1947.

Three-engine twin-engine radial engine, developed for light aircraft and helicopter, reportedly weighs 14 lb and develops 15 hp with 21 in. of displacement. Four-engine has been announced by W. C. Johnson, 6011 Elgin St., Los Angeles.

Chapman Helicopters, Ltd., Vancouver B.C., has added a full 473-hp engine to its fleet of 35 Bell and 18 Sikorski. Model 477 incorporates an auto window in the lower right-hand corner of the right door to permit an air-drawn window while on the ground.

Cash International Research Division of General Electric, formerly at LaGuardia Airport, N.Y., has moved to Sky Harbor Airport, Phoenix, Ariz., to be closer to the major defense manufacturers on the West Coast.

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Dwindling Aircraft Market Caused Production Halt of Cessna's 620

Wallops—Dwindling market caused by aircraft owner's desire to dispose of large numbers of piston engine aircraft is responsible for jet transports (AVF Sept. 2, p. 37) was another factor in decision by Cessna Aircraft Co. to suspend production of its Model 620 four-engine piston-engine business plane.

Development Cost Rise

Cost of developing the airplane to meet Civil Aeronautics Administration part OHD transport category requirements also was higher than originally contemplated, according to sources within the company. Increased costs placed the airplane in an unprofitable price area—considering the reduced market potential and necessary business plan—all obstacles to quantity production.

However, another important development that shored Cessna's market for the 620 has been the rapid acceptance of the light twin business plane in which field in Model 510 is a strong contender. Because one of the two airplanes has now been sold out to the rate

of growth of large multi-engine types, industry observers note. Cessna spokesmen confirmed that this was also a factor in reducing the 620's market potential.

Cessna indicates that there were the major reasons for dropping the 620 before it got into additional high expenditures needed for production—it categorically denies that any technical problems had developed.

Cessna's loss was the heaviest blow suffered by a business aircraft manufacturer in past several years. Immediate effect is liquid of some 100 personnel connected with the 620, although the company states that it is eliminating some on other programs. Officials intend to disclose how much it had invested in the program. One prototype has been flying since the summer of 1976 and recently passed Phase I flight tests for CAA. A complete airframe, engine, and equipment was built for static testing. First production models of the nine-to-thirteen-passenger transport were scheduled to come off the line of the new Walling Plant in early 1978.

Cessna's board has voted the regular quarterly cash dividend of 35 cents payable Nov. 15 to stockholders of record on Nov. 2. Sales of 570 airplanes in fiscal 1977 exceeded previous year's \$66 million, but income was down nearly to increased military business. Earnings for fiscal 1977 were \$501 per share compared with \$548 per share in 1976, reflecting lower profit margins from military business, also increased engineering costs. Recent payment cutbacks reported on construction by the Jet Forge has required Cessna to spend additional financing. Company expects 1978 fiscal year preliminary volume to equal past year if no schedules are changed. Total business in fiscal 1978 is expected to pass \$70 million, according to Cessna President Dwight L. Wallace.

Daughen Aircraft

Large development outlays of the Douglas DC-8 jet transport program and the conservative policy of writing down investments in other DC-8s to the estimated recovery value continued to reduce Douglas Aircraft Co.'s net earnings for the first three quarters of fiscal 1977, the company said. Douglas reported net earnings of \$25,013,472 as sales of \$825,417,000. Current earnings were reduced to \$24,719,466 or \$6.67 per share by a re-

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Canadian Air Terminal Development

Terminal building at Montreal's Dorval Airport (top) will be completed next year, but installation of electronic, other equipment, will delay operations one week only 1959. The usual facilities for health, navigation and customs inspection, one waiting room for arriving passengers and one for the public. Bottom photo is of recently completed terminal building at Quebec City Airport.

AVIATION WEEK, November 21, 1957

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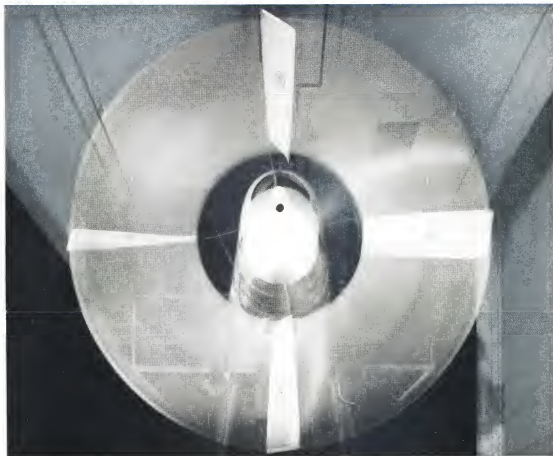
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